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September-October 1954

METAL TREATING

FOURTH ANNIVERSARY ISSUE

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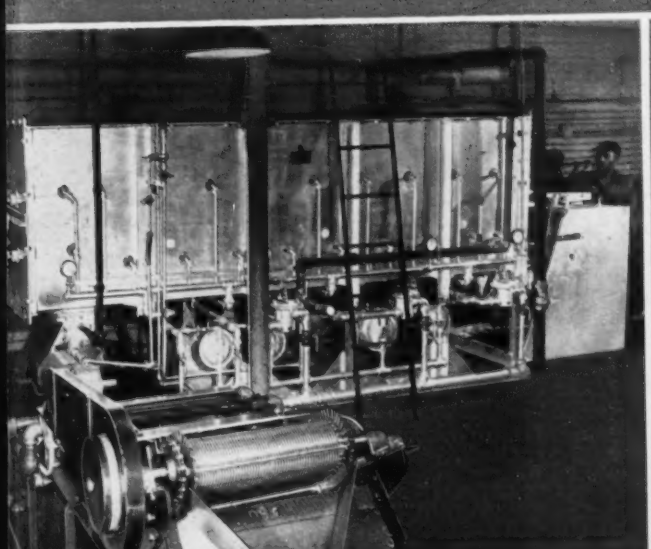
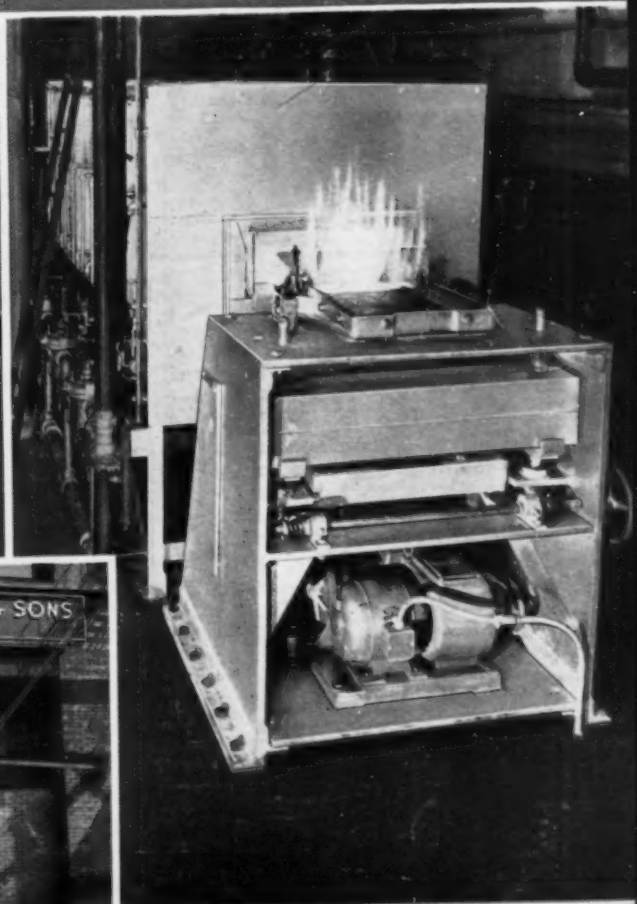
MASTER CRAFTSMEN
METAL TREATING INSTITUTE

The installation of new, large size Shaker Hearth Furnace at a Commercial plant is described in this issue. See page 4.





The Only MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

Better Brazing

that actually costs less!

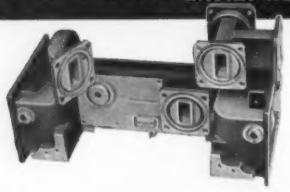
Saves $25,000 ANNUALLY!

SAE-1010 steel bicycle forks are brass brazed at the rate of 280 forks per hour in a mechanized Ajax salt bath unit that brazes, washes and dries the forks automatically. Production has been increased 270%.

THE BRAZING IS PRACTICALLY Free!

Brazing and carburizing of this SAE-1010 steel sprocket assembly are completed simultaneously with one heating of the work in an Ajax salt bath carburizing furnace. Hub is brass-brazed to sprocket body . . . The assembly is file hard after oil quenching.

Tolerances OF 0.002" EASILY HELD!



Micro-wave components, like this aluminum wave guide, can be aluminum dip-brazed, holding tolerances of 0.002". Fast brazing time and uniform bath temperatures (guaranteed within 5°F of control point) give high production and uniform results.

LABOR Costs Cut 96%!

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Brass Brazing of Steel Parts — Brass brazed joints are fully as strong as those of copper! This money-saving method is possible *only* with a salt bath furnace, thanks to its greater heating speed — so fast that no dezincification of the brazing metal occurs. Brass brazing at 1700°F compares with 2050°F for copper. The lower temperature greatly reduces grain growth and distortion of the steel. Operating costs are less.

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Write for ... Bulletin 124, also list of documented brazing case histories covering a wide variety of industries.

Send ... Your sample parts to the Ajax Metallurgical Service Laboratory for processing. No cost or obligation.

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MASTER CRAFTSMEN
METAL TREATING INSTITUTE

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METAL TREATING

EDITORIAL

HAPPY BIRTHDAY TO US

"Tempus," as some ancient Roman wisely remarked, "fugits." The fact is forcibly brought home to us again as this issue of METAL TREATING goes to press.

Here we are at our Fourth Birthday and, like other forms of life and action, growing bigger and smarter every day.

Here's proof:

METAL TREATING

September-October 1950	*September-October 1954*
Vol. I—No. 1	*Vol. V—No. 5*
Total Pages—20	*Total Pages—48*
Feature Articles—3	*Feature Articles—6*
Departments—3	*Departments—5*
Number Advertisers—9	*Number Advertisers—30*

From our first issue we have kept our sights focused on one fundamental—to establish a technical, informative, helpful magazine about heat treating for the heat treater—with no furbelows, or side issues, or vaguely related tangents to distract our editorial themes or widen our advertising scope—(a temptation to which many trade or technical magazines succumb).

Our slogan—"The Only Magazine Devoted Exclusively to the Heat Treating Industry"—is still our concept of usefulness to a segment of American industry whose truly *vital* importance is emphasized daily and increasingly as progress, and new products, and new ideas develop regularly on our economic scene.

Happy Birthday to Us, but more important—thanks to our authors, our advertisers, our salesmen and, of course, our readers for their support and interest. With these we cannot fail to go on to still greater achievements.

C. E. Herington

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Strategic Use of Outside
HEAT TREATING FACILITIES CAN CUT COSTS

By **ERNEST M. OLSON**
Superintendent of Assembly
Pittsburgh Equitable Meter Division
Rockwell Manufacturing Company

Regular use of the facilities of outside heat treating concerns can mean important savings for the manufacturer whose volume in items requiring special heat treatment is not sufficient to justify the cost of keeping furnace temperatures up constantly —or who faces the problem of having to add extra equipment as his heat treating requirements expand.

Careful selection of a properly equipped and properly manned heat treating shop and development of a high degree of teamwork between shop and manufacturer are the major requirements for a successful arrangement of this sort.

If these conditions are met, the manufacturer may even discover that it is to his advantage to continue the arrangement even after his volume increases. Free metallurgical consultation services and sufficient equipment to meet any special finishing needs are two important advantages offered by high-grade metal treating firms.

In our case, we have realized estimated savings of about 25 per cent by making strategic use of the facilities of an outside heat treating company for treating steel gears, shafts and bearing parts for our line of Rotocycle gasoline, oil and industrial meters.

Our results have been so satisfactory that we are now also using this shop exclusively for heat treating of production tools and dies used in our Pittsburgh plant.

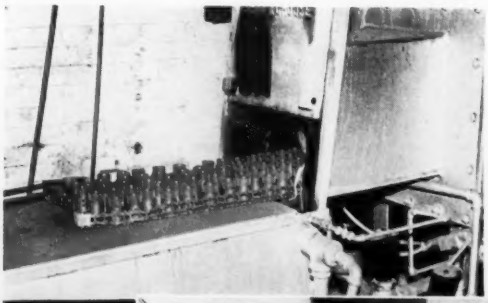
High-quality heat treating is essential for Rotocycle parts, which must be able to resist the effects of erosion and heavy wear caused by passage through the meter of all sorts of liquids at rates of flow of up to several thousand gallons a minute.

For some time we did our own heat treating on these parts, using a salt bath furnace. This was too expensive to be satisfactory, however, because it was necessary to maintain furnace temperatures at a high level throughout each week to prevent dissolution of the salt bath—even though we did not have enough parts running through to justify operating the furnace more than two or three days a week.

TYPICAL OPERATIONS—

Rotocycle gears spot checked before packing and shipping to heat treating plant.

Heat treatment at Pittsburgh Commercial Heat Treating Co., Pittsburgh, Pa.



◄ Controlled atmosphere hardening

Chapmanizing in salt bath furnace ►

Cleaning heat treated gears liquid blast cabinet.

Metal Changes Spur Shift

What finally brought about our decision to use outside heat treating facilities was a series of design and specification changes in Rotocycle parts, making it necessary to heat treat a wide variety of SAE steels. Had we decided to take this in stride and continue doing our heat treating with in-plant facilities, it would have involved purchase of considerable additional equipment, provision of additional plant space, carrying more insurance, higher maintenance costs and the hiring of experienced help.

To avoid these increased costs, we began to investigate outside sources for heat treating with a view to determining what savings might be achieved by having the work done elsewhere. Arrangements were made through our purchasing department to have representatives of various local heat treating concerns come to our plant to discuss our heat treating problems with us.

Following these discussions, we submitted drawings and samples of our parts to the various concerns. The samples were treated and returned for checking and approval by our Inspection Department for quality and test. Cost statements on heat treating of each item were submitted to our accounting department for comparison with our estimates of what the price should be.

On the basis of comparative costs and tests, we tentatively selected one company and, along with representatives of our own purchasing department, toured their plant to make a close study of their facilities and procedures.

By this visit we satisfied ourselves that the company was equipped to handle all heat treating assignments we might conceivably throw their way, including hardening of all types of SAE steels and annealing and stress relieving of castings.

Another important consideration in our selection of this concern was the fact that it is also equipped to handle plating work, thus eliminating time and handling costs involved in sending heat treated

Partial view of plating room where Rockwell parts are copper, tin and cadmium plated or anodized, blackened, etc.

work to another company for plating as we had been doing.

Planning Cuts Costs

In order to carry out this arrangement with maximum efficiency, it was necessary for us to establish as quickly as possible standard procedures for handling of parts, proper packaging and parts identification, transportation and production scheduling.

Except for the smallest pieces, for which we are charged on a per pound basis, all charges are made on a per item basis. Accordingly, to simplify handling, all except the smallest item sent out for heat treating are packaged in self-counting boxes and containers.

In addition to being listed in order, each piece or container is properly marked or tagged to identify it and to indicate the type of metal used and work to be done.

The work is transported to the shop, a distance of several miles, in Rockwell trucks and picked up by them the following day. This 24-hour schedule

(Continued on page 30)

Hardness testing at Pittsburgh Commercial plant after heat treating.

Internal examination of sample gears at heat treating plant laboratory.

Measuring sample gears with optical comparator at the Standards Room of Rockwell Mfg. Co.

Checking pitch diameter on sample gears at the Rockwell Standards Room.

New Shaker Hearth Furnace

INCREASES PRODUCTION

By ***F. C. SCHAEFER***
American Gas Furnace Company
Elizabeth, N. J.

Metalworking is no small part of industry in New York City. Here exist thousands of concerns, all within the radius of a few miles, manufacturing buttons, spring clips, fasteners, jewelry, scales, shoe shanks, bolts and every conceivable kind of small part, many requiring heat treatment. Serving many of these concerns is the plant of Fred Heinzelman and Sons in lower Manhattan.

To meet the production and semi-production requirements of its varied customers, the company installed its first continuous reciprocating or shaker hearth furnace several years ago. Continued success with this type of equipment and an increase in certain kinds of business have led to the new installation illustrated in Fig. 1 (See cover also.)

The installation, as shown, consists of an American Gas Furnace shaker machine with a continuous automatic quenching tank. The discharge of the tank has been raised and work, after being quenched, now discharges onto the conveyor of a Blakeslee washing machine recently installed. See Fig. 2.

This equipment is being used to harden small or light-weight parts requiring an exposure to hardening temperature for only three to four minutes, at rates up to 350 pounds per hour; and heavier pieces up to ½" diameter by 8" long at a rate of 400 pounds per hour. Processing time can be varied at will by varying the number of strokes and the force of the bump.

It is not unusual to interrupt a run of several hours or days duration to sandwich in an hour or

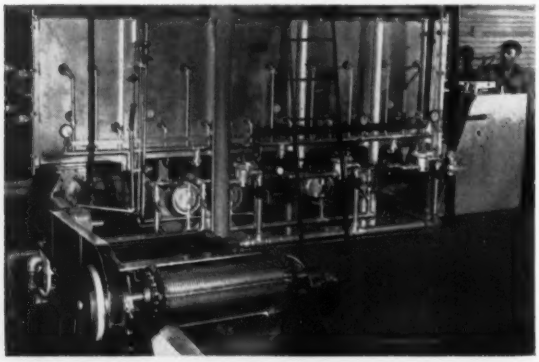


Fig. 1—Overall view of equipment. Quench conveyor in foreground unloads on washer conveyor recently installed.

Fig. 2—Bright hardened parts as they leave the quench tank.

two of a different kind of work without intermixing. The work is visible to the operator through the entire heating cycle and it is easy to see where one batch leaves off and the other begins.

The furnace has an operating temperature range from 1400° F. to 1850° F. The following list of types of steel hardened and their hardening temperatures are typical of the variety of materials treated:

Type of Steel	*Hardening Temperature*	
1040	1550° F.	(Oil quench)
1050	1525° F.	" "
1070	1475° F.	" "
1090	1450° F.	" "
4130	1575° F.	" "
4140	1550° F.	" "

Typical heat treated parts are shown in Figs. 3 to 7.

The moving hearth of the furnace, supported on free alloy rollers, is entirely enclosed in its heated position to permit complete control of the furnace atmosphere. A Lindberg Hyen generator serving other furnaces has enough capacity to supply atmosphere requirement (about 150 cubic feet per hour) for bright hardening of high carbon and alloy steel parts and to act as a carrier gas for light carburizing or Ni-Carbing (ammonia carburizing). Several production runs of drive nails and self-tapping screws have been treated successfully with no more complication than the addition of a small amount of propane and ammonia. A mixing cabinet is installed near the controls of the furnace to meter Hyen gas, propane and ammonia. In addition, a Nitroneal generator serves as a standby and is used for clean, neutral hardening plain carbon and alloy steels.

The equipment may also be used for clean hardening heat treatable stainless steels. While the brightness obtained by cooling in atmosphere retorts would not be achieved, somewhat better physical properties can be expected.

The heating space of the furnace, 18" wide by 9' long, is divided into four zones of small burners

firing above and below the muffle. Standard Brown instruments are provided to regulate the heat input to various parts of the furnace as may be called for by the type of work. Temperature can be varied for a slow heat up or for a rapid heat up with a longer time at heat. A complete strip chart record is made of the discharge temperature, thus providing assurance that work is quenched at the temperature specified.

Through the natural shaking of the hearth, the work passed through has a tendency to spread out into a thin uniform layer. Thus, each piece receives the same heat exposure as every other piece and tumbles off the end of the hearth in what amounts to an individual quench. Distortion of thin flat pieces is minimized and uniformity is assured.

Like most modern furnaces, the lining of the furnace is composed of insulating refractory backed by block insulation. Also, by the nature of the conveying mechanism, only the work enters and leaves the furnace, making for high thermal efficiency and improving surrounding working conditions.

The alloy muffle is a 60% nickel–12% chromium casting. The moving hearth is also of 60-12 alloy and is supported by numerous free rollers on the muffle floor, kept in place by a slotted alloy sheet. By thus reciprocating the hearth only, physical shock does not affect the muffle and cold work never touches the muffle, eliminating thermal stressing of the muffle, a major factor in muffle life. The muffle itself is supported on alloy tubes atop brick piers. Should the moving hearth ever need cleaning or repair, it can be removed and replaced within a matter of minutes.

The actual operation of the furnace is taken care of by one man who, with the aid of some small strategically located hoists, brings work to the furnace, feeds it and disposes of it at the end of the process.

The quenching tank is approximately 5′ deep and 12′ long, with a 24″ wide belt. The free fall of work through the quench oil is approximately 30″ before it reaches the belt. The belt is of very fine Audubon cord weave construction permitting quenching of very small, as well as large heavy parts. A 150 G.P.M. pump recirculates oil to provide suitable agitation through a strategically located manifold moving hot oil away from the quench area. The tank is equipped with a four-speed gear transmission to accommodate different work and a special friction clutch which slips if work should jam the belt, thus avoiding belt damage. The discharge point of the conveyor has been elevated to discharge onto the washing machine conveyor.

The washer is a Blakeslee single tank pump type wash and drying unit with a through conveyor 18″ wide and underneath return. The tank itself has a capacity of 225 gallons. The wash is accomplished by drilled pipe headers above and below the belt. Hot solution is obtained through an immersion type gas-fired heating coil. The 5′ wash section is followed by a recirculating type air dryer, also gas heated, 6′ long. The overall length of vestibules, washer and dryer is 21′ 6″. Total time through the unit varies from approximately 5 to 15 minutes.

Considering its production capacity, the installation occupies a minimum of floor space. The furnace runs along one wall with the quench at right angles. The overall furnace and tank is about 17′ in one direction and approximately 18′ over furnace, tank and washing machine. The resultant "U" provides a place to store work before and after processing.

Now in practically daily operation this new production equipment shows every sign of continuing trouble-free operation and has increased production capacity to the benefit of both owner and customers.

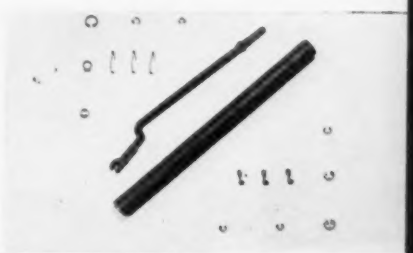


Fig. 3—The size of parts handled by the equipment is illustrated by the variety shown here. Round bar is 8" long.

Fig. 4—Consumer items such as nails, beret clips, buttons, etc., comprise a large part of output.

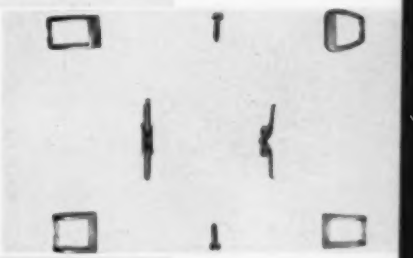


Fig. 5—Dry cyanided, low carbon steel parts require eight to thirty minutes at heat in propane and ammonia (with carrier gas) atmosphere.

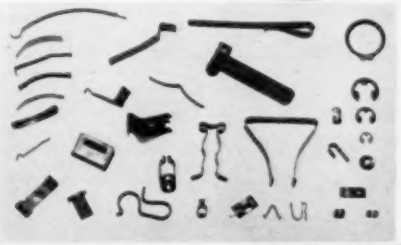


Fig. 6—Springs and spring clips are regular items.

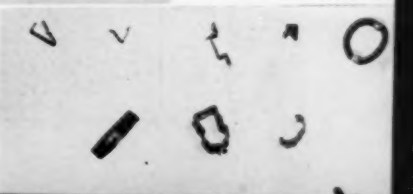


Fig. 7—Miscellaneous electronic component parts after hardening and tempering.

Editor's Note—The following articles are the last two in the series Cost Accounting. *"Determination of Expenses"* and *"Allocation of Expenses,"* first two papers in the series, appeared in the July-August issue.

DETERMINATION OF UNIT COSTS

By **JOHN C. PATERSON,** *Treasurer*
Commercial Steel Treating Corporation
Detroit, Michigan

This paper will deal with the final steps to be taken to produce the unit costs that we all must have in order to price and quote intelligently, and above all, at a profit. The term Unit Cost, as used here, might otherwise be referred to as an hourly rate on a furnace, an induction machine, a sand-blast machine, a straightening press, etc.

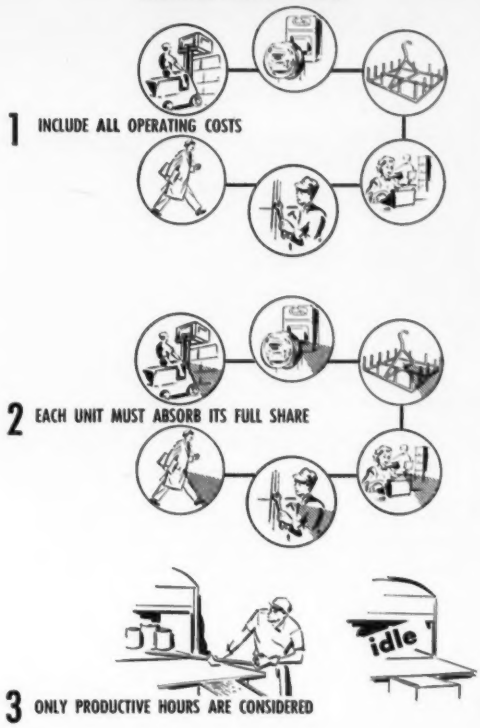
There are three basic principles to be considered in the determination of reliable unit costs.

(1) The rates must collectively absorb all of the operating costs of the business, for the period on which they are based.

(2) Each productive unit must absorb its actual share of the costs.

(3) The costs applicable to each productive unit must be absorbed by only the productive hours of the unit.

The first two articles outlined procedures for recording all costs of operating the business and charging each productive department with its proper share of the costs. Each individual productive unit must now be charged with its portion of the costs and an hourly rate determined for each unit.


BASIC PRINCIPLES IN DETERMINING RELIABLE UNIT COSTS
1 INCLUDE ALL OPERATING COSTS
2 EACH UNIT MUST ABSORB ITS FULL SHARE
idle
3 ONLY PRODUCTIVE HOURS ARE CONSIDERED

It is obvious that hourly rates can not be computed without knowing the number of hours that each unit was producing during the period on which the cost analysis is based. There are various ways in which this data may be accumulated. One method would be to have leadmen or foremen make weekly reports. This report may be in simple form listing only productive hours for each unit, or it may be designed to include a classification of idle equipment time as to the various major causes of such idle time. The simple form serves the purpose of this cost study and Table III* gives an example of such a report. The reports may be summarized and the results posted to a Productive Equipment Schedule. The schedule will list all units of productive equipment and show the number of hours that each was producing during the base period. This data is required in the final computations of hourly rates. It is also used in the distribution schedules for power, fuel and material handling. (See "Allocation of Expenses," May-June issue).

The distribution of departmental costs to the

TABLE III

PRODUCTIVE EQUIPMENT REPORT

DEPARTMENT ..... SHIFT ..... WEEK ENDED ....

	EQUIPMENT NUMBERS									
	1	2	3	4	5	6	7	8	9	10
MONDAY										
TUESDAY										
WEDNESDAY										
THURSDAY										
FRIDAY										
SATURDAY										
SUNDAY										
TOTAL										

SAMPLE FORM

* All tables in the four articles on Cost Accounting are numbered consecutively. See July-August issue.

TABLE IV

UNIT COST SUMMARY							
COST ITEMS	FURNACES						DEPARTMENT
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	TOTAL
Direct Labor Costs							
Treating Materials and Fixtures							
Electric Power							
Fuel (Gas and Oil)							
Water				SAMPLE FORM			
Building Occupancy							
Quality Control							
Equipment Maintenance							
Material Handling							
Fixed Charges							
Total Factory Costs							
General and Administrative							
Total Operating Costs							

individual productive units calls for a "Unit Cost Summary" as shown in Table IV. This is similar to the Departmental Cost Summary (Table II) except individual units are listed instead of departments, and there is a separate summary for each department. If desired the two summaries can be consolidated. To accomplish this the Departmental Cost Summary would be expanded to list each furnace, etc., grouped by departments with columns provided for departmental sub-totals. If the plant is not divided into departments, the summary would simply be a "Unit Cost Summary."

The procedures of allocating and charging the Distribution Accounts and Direct Expenses to departments, as described in the second article, apply in principle to the further breakdown of costs by individual units of equipment. In fact, most of the schedules which were described for the distribution of the various cost items actually break the costs down to furnaces and the other productive units. These schedules, therefore, provide details for posting to the "Unit Cost Summary." However, three of the cost items require additional treatment because, for practical purposes, the initial distribution is only by departments. The items in question are Direct Labor, Treating Materials, and Quality Control.

It is not difficult for the foremen or employees to keep a record of direct labor hours by departments. However, with certain exceptions, keeping a record of the labor by furnaces would involve complicated and arbitrary timekeeping procedures. In some cases, one man may operate two or more furnaces, while in other cases, two or more operators may work as a team. Total direct labor costs of a department may be allocated to the furnaces therein, on the basis of relative productive capacities adjusted to reflect differences in productive hours. Take for example, a hypothetical department consisting of three liquid carburizing furnaces of different sizes. The procedure would be as follows:

FURNACE NUMBER	RELATIVE CAPACITY*	PRODUCTIVE HOURS**	CAPACITY UTILIZED	DISTRIBUTION FACTOR
1	100	6,500	650,000	24.8%
2	150	5,400	810,000	30.9%
3	200	5,800	1,160,000	44.3%
			2,620,000	100.0%

*Pounds Per Hour
**During Base Period

These same distribution factors can be used to allocate the cost items of Treating Materials and Quality Control. This method of allocation can be applied to any department or section of the plant comprised of similar types of equipment and operations.

There are certain types of supplementary direct labor that should not be included in the determination of equipment rates. The following types of direct labor costs should be applied as an extra in pricing or estimating: wiring, non-case painting, packing carburizing pots, clamping, etc. This means of course, that this labor must be segregated in the payroll accounting.

The manner in which direct labor is used varies in different heat treating plants, depending upon plant size, facilities, types of jobs processed and shop management. A study of the direct labor functions of any particular plant will reveal the factors to be used in determining the amount of direct labor cost applicable to each productive unit. Both complicated and arbitrary timekeeping procedures should be avoided. But if unit costs are to be realistic, sound methods of determining labor costs are essential.

Here is a relatively simple alternative method of determining direct labor unit costs. It has certain practical advantages meriting consideration.

On the basis of experience, rate each productive unit (furnace, sandblast machine, straightening

press, etc.) as to direct labor requirements under normal operating conditions. Examples: (1) One man may be able to operate two conveyor furnaces. Therefore, the direct labor requirement is ½ man per furnace hour. (2) Two men may operate five cyanide pots. The direct labor rating would be 2/5 man hour per furnace hour. (3) A straightening press would require a full man hour per press hour. A large press would need two men.

The next step would be to set up a schedule of prevailing wage rates. If rate differentials follow departmental lines this should be reflected in the application of rates to the direct labor requirements of the respective units. Where rates vary within a department, or where men are not assigned to specific furnaces or other equipment on a fairly permanent basis, average rates would be used.

Using the five cyanide furnaces as an example, the direct labor cost per furnace hour would be computed as follows: (The figures used in the example are purely hypothetical)

2/5 Man hour @ $2.00	.80
Adjustment factor 20%	.16
Direct Labor	.96
Labor Allowances 25%	.24
Direct Labor Costs	1.20

The 20% adjustment factor is to offset nonproductive time. Time lost due to personal causes, rest periods, etc., will probably average 10 minutes for each hour of wages paid. The adjustment factor is computed as follows:

Minutes paid per hour 60
Minutes worked per hour 50

$$\text{Minutes paid per hour worked} \quad \frac{60}{50} \times 60 \quad 72$$

$$\text{Adjustment factor} \quad \frac{72-60}{60} \quad 20\%$$

The percentage used for labor allowances is the relation that the total of such costs bears to the total payroll.

This method of arriving at direct labor unit costs offers certain advantages.

(1) It eliminates the necessity of keeping daily work cards on direct labor.

(2) It eliminates the work of tabulating and summarizing work cards.

(3) It establishes the specific amount of direct labor included in a furnace hour rate, in terms of time as well as dollars.

(4) The unit rate can be readily adjusted to fit a job which requires more or less direct labor than is contained in the standard rate.

(5) The unit rate can be easily changed to reflect increases in wage rates.

Two possible disadvantages in the use of this method would be the absence of general ledger control and the resulting danger of not absorbing all of the actual direct labor costs. However, these disadvantages may be partially overcome in the following manner.

Periodically compute the total rated direct labor costs of the plant by multiplying the productive hours of each unit by its rated direct labor cost per hour and run a total on the rated costs of all units. Compare the total rated direct labor cost with the actual cost for the period as indicated by the payroll summary. If there is only a nominal difference in the two totals, the accuracy of the method would seem to be confirmed.

We suggest as the final step in developing unit costs, that a Rate Sheet be set up for each piece of productive equipment as in Table V. The cost figures for the rate sheets come from the Unit Cost Summary. These rate sheets can be assembled in a loose leaf binder for use by the pricing and estimating department.

TABLE V

RATE SHEET

Equipment Number ..... Department .....

Description ..... Size .....

Rated Hourly Capacity ... Productive Hours Per Year ...

Cost Items	Cost Year 19—	Hourly Cost*
Direct Labor Costs		
Treating Materials		
Electric Power		
Fuel (Gas, Oil)		
Water		
Building Occupancy		
Quality Control		
Equipment Maintenance		
Material Handling		
Fixed Charges		
Total Factory Costs		
General and Administrative		
Total Operating Costs		

SAMPLE FORM

*Annual Cost Divided By Productive Hours

How often should rates be reviewed? A complete review each year would seem to be advisable. In the interim adjustments should be made to reflect any substantial changes in costs. ■ ■ ■

APPLICATION OF UNIT COSTS

By **K. U. JENKS,** *Secretary and Treasurer*
Lindberg Steel Treating Company
Melrose Park, Illinois

The preceding articles have outlined methods and procedures that may be employed in the development of reasonably accurate unit costs. These procedures, or modifications thereof, should be adaptable to any heat treating plant.

By use of unit rates, costs can be figured on a job regardless of the number of operations involved. Each unit rate is flexible because it is made up of well defined components. On some jobs one or more of the component costs may be more, or less, than is included in the standard rate. In such case the unit rate is readily adjustable. However, standard rates will cover a large percentage of the jobs processed.

Most commercial heat treaters make up a shop order or work ticket on each job. Each operation is recorded on the shop order, showing the equipment used and the time required to complete the operation, as well as other pertinent information.

In figuring cost on a job by use of unit rates, equipment time is multiplied by the respective rates. Wiring, packing, painting, special fixtures, etc., are figured as extras. Trucking should also be figured as an extra at predetermined rates for different types of materials or parts. The procedure for estimating or quoting is the same except that equipment time and extras are estimated. Of course, estimated costs should be checked against actual costs after a job goes into production.

It is not practical to use furnace rates for figuring costs on small jobs which are less than furnace loads. Graduated cost schedules can be worked out to cover odd lots. The same approach is suggested for figuring cost of heat treating tools and dies.

A complete cost accounting system in a manufacturing business would include a profit and loss statement for each product line. However, manufacturing operations lend themselves to that phase of cost accounting far better than do most commercial heat treating plants. The reasons are fairly obvious. The various steps in the production of a manufactured article are usually repetitive; the departmental divisions of the plant usually follow a product line; the accounting department is able to set up income and expense accounts applicable to each product. In contrast, the variables entailed in the services rendered by the average commercial heat treater make it almost impossible, in my opinion, to produce a factual income and expense statement for each service rendered. The jobs processed in any one day involve many combinations of various services.

Even if it were possible to unscramble these endless numbers of treatment combinations, there would still be innumerable variables within each type of service. To name a few, there are the many different—*Types of Steel—Sizes—Shapes—Designs—Surface Conditions—Heat Treat Specifications—Tolerances—Lot Sizes—Heating Cycles, etc.*

It is, therefore, doubtful that a profit and loss statement on each type of heat treating service would serve any useful purpose. It will not provide the answer to the $64.00 question—Which jobs are profitable and which are not? The only way to get the answer to that question is by application of unit costs to the individual job.

A BASIC SYSTEM APPLICABLE TO EITHER TYPE OF OPERATION

If this line of reasoning is correct, the commercial heat treater will do well to concentrate his cost accounting efforts upon the development of sound unit rates. Each unit rate should, as accurately as possible, reflect its proper portion of every operating expense.

The Committee has concerned itself primarily with the consideration of cost methods which are applicable to a commercial heat treating plant. It is possible, however, to draw a parallel between

(Continued on page 43)

Heat Treating

ALUMINUM 'SUPERALLOYS'

By **THOMAS A. DICKINSON**
West Coast Reporter

As a result of accurate control, Consolidated Vultee Aircraft Corporation has been able to do an outstanding job on the heat treating and working of 75S aluminum "superalloys."

For instance, where it was once believed that 75S parts could be satisfactorily heat treated or annealed if they were "reasonably clean," experience has proved that there is no substitute for careful cleaning if surface oxidation is to be avoided. Therefore, Convair's current specifications call for:

(a) Removal of grease pencil markings, paint and tape residue, etc., with rags soaked in methyl ethyl ketone or an equivalent organic solvent.

(b) Vapor degreasing of parts (which are stacked on racks so as to permit the free circulation of vapors around all surfaces of each component).

(c) Immersion in an alkaline cleaner with a temperature of 150 to 180°F. for 15 to 30 minutes.

(d) Drainage of the parts for 10 to 15 seconds, followed by a rinse in water (with a pH of less than 9.0 and a temperature of 100 to 130°F.) for at least three minutes.

Parts to be heated in an air furnace are next placed in racks and separated by spacers or arranged in a manner that will permit maximum circulation. Some parts may be "nested" or stacked together, if their built-up thickness does not exceed 3/8", and none can be loaded beyond a specified temperature distribution zone designated on each individual furnace.

Those components which must be treated in a salt bath are stacked or racked so that distortion due to the weight of pocketed salts will not occur when they are removed from the bath. Fig. 1 illustrates the handling of individual parts.

The solution heat treating range for all 75S alloys processed by Convair is 860 to 930°F. Table I indicates soaking time for components comprising these materials including forgings and parts machined from heavy plate stock.

Salt bath soak time begins after a load is inserted and the control couple returns to its original setting. Where an air furnace is used, soak time begins when the last recorder thermocouple reaches the minimum of the desired temperature cycle range.

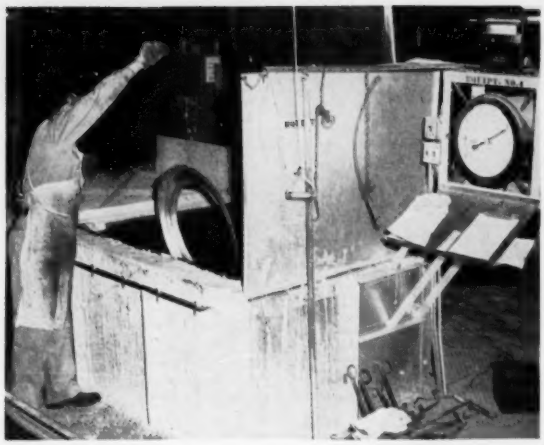


Fig. 1—An individually heat treated 75S part is removed from a salt bath after soaking.

Mixed gauges of clad materials are simultaneously heat treated in a single air furnace if the soaking time of the gauges falls within the ranges shown in Table I. For example, 0.0170" and 0.0640" gauges of material can be combined in one load if a 20-minute soak interval is used.

Quench delay times for solution heat treated 75S alloys are 5 seconds for 0.016" gauge stock; 7 seconds for 0.020" to 0.0250" gauge stock; 10 seconds for 0.0260" to 0.090" gauge stock; and 15 seconds for 0.0910" gauge or heavier stock. See Fig. 20.

Parts are quenched in cold water, the temperature of which is not allowed to exceed 100°F. If they have been salt treated, the parts are also rinsed in a separate tank with fresh running water for at least three minutes to remove adherent salt.

Bare 75S extrusions, plate, sheet, and strip may be re-heat treated as many as five times. Clad sheets which are 0.1250" or less thick can be re-heat treated only once; if they are more than 0.1250" thick, they may be re-heat treated as many as three times.

Fig. 2—75S aircraft component is quenched, following heat treatment in a salt bath.

Table I
Solution Heat Treating Soaking Time

Gauge	Soaking Time, Minutes	
	Clad Material (Range)	Bare Material (Minimum)
.016 and under	10- 15	10
.017- .020	10- 20	10
.021- .032	15- 25	15
.033- .064	20- 30	20
.065- .091	25- 35	25
.092- .125	30- 45	30
.126- .250	35- 45	35
.251- .500	45- 55	45
.501-1.000	65- 75	65
1.001-1.500	85- 95	85
1.501-2.000	105-115	105
2.001-2.500	125-135	125
2.501-3.000*	145-155	145

Deviations in the foregoing routine are allowed by Convair only in work with very thick parts such as those made from forged billets and plates which are three or more inches thick. The latter are solution heat treated in the rough-machined condition for a 75S-W temper, then they are finish machined and aged to the 75S-T6 condition.

Age hardening may be started at any time after heat treated 75S parts are quenched, and may be performed in either an air furnace or a salt bath. Table II indicates times and temperatures for the continuous and progressive precipitation heat treatment, or artificial aging, of 75S aluminum alloys.

In the progressive cycle, which consists of heating the parts at an initial temperature and then heating to a higher temperature for a period of hours, the time to reach the higher temperature is limited to 45 minutes. If the time should exceed 45 minutes, but is not longer than 60 minutes, second-stage heating time is reduced 15 minutes.

Table II
Age Hardening Time & Temperature

Material	Temperature	Time
All 75S-W Materials— Sheet, Bar, Extrusions, etc.	250 ± 5°F (a)	23 ± 1 hours
	212 ± 5°F (b)	4 ± ¼ hours then
	315 ± 5°F	8 ± ¼ hours
75S-W Sheet Only	250 ± 5°F (b)	3 ± ¼ hours
	325 ± 5°F	3 ± ¼ hours

(a) Continuous (b) Progressive

Table III shows mechanical properties specified by Convair for 75S alloys in the SO, and S-T6 conditions.

(*Continued on page* 40)

Table III
Mechanical Properties of 75S Alloy

Material and Temper	Thickness (Inch)	Tensile Strength Min. Lb./Sq. In.	Yield Strength Min. Lb./Sq. In.	Elongation Min. % in 2 In.
Clad 75S-O		36,000 (Max.)	15,000	10
Clad 75S-W (As Quenched)		46,000	24,000	20
Clad 75S-T6 Plate & Sheet (Heat Treated and aged)	Up to .039	70,000	60,000	7
	0.040 to 0.250	72,000	62,000	8
	0.250 and over*	——	——	—
Bare 75S-T6 Plate & Sheet (Solution Heat Treated & Artificially Aged)	0.016 to 0.039	76,000	65,000	7
	0.050 to 0.500	77,000	66,000	8
	0.501 to 1.000	77,000	66,000	6
	1.001 to 2.000	77,000	66,000	4
	2.001 to 2.500	73,000	62,000	3
	2.501 to 3.000	70,000	60,000	3
Rolled or Drawn Bars & Rods, Round, Rectangular, Hexagonal	Up to 3.0 In., 30 Sq. In. Max. Cross Section	77,000	66,000	7
Wire	0.040 to 0.124	77,000	——	—
	0.125 to 0.374	77,000	66,000	7
Extrusions— Bar, Rod & Shapes	Up to 0.249 Incl.	78,000	70,000	7
	0.250-2.999" (all sections)	80,000	72,000	7
	3.000-4.499" 20 Sq. In. Max. Cross Section	80,000	70,000	7
	3.000-4.499 Incl. Over 20 to 32 Incl. Sq. In. in Cross Sec.	78,000	70,000	6
	Over 4.500-5.000 Incl. & to 32 Sq. In. Cross Section	78,000	68,000	6
75S-T6 Die Forgings & Parts Machined From Forging Stock		75,000	65,000	10**

* See the Metallurgical Group of the Engineering Test Laboratory for Test Requirements.
** When tensile test specimens are machined from heat-treated forgings not over 3" thick (with the axis parallel to forgings flow lines), elongation may be as low as 7.0%.

The Economics Of

ANHYDROUS AMMONIA FOR INDUSTRIAL APPLICATIONS

By **A. E. WASTIE,** *Vice President and Chief Engineer*
Thomas Gas Contractors
Westfield, N. J.

In the past few years, anhydrous ammonia has made rapid strides in its usage for metal treating, water treatment, the rubber industry and many other industrial applications, due to lower overall costs, high purity and very low dew point or dryness.

Anhydrous ammonia is used in the metal treating industry for nitriding, carbonitriding and metal sintering. Dissociated ammonia can be used for bright annealing, metal sintering, furnace brazing and other uses where a highly reducing atmosphere is required. Up to a few years ago free hydrogen was used for a reducing atmosphere, and bright annealing. Free nitrogen has been used for controlled neutral atmosphere and to prevent oxidation of metal.

Using free hydrogen for various heat treating applications, a considerable storage area must be set aside for cylinder or bulk storage. Naturally, with the storage of a combustible gas, a rigid safety program is mandatory. Using such a system, hydrogen gas is piped from storage, usually a considerable distance to the point of use. With long piping runs, the percentage of leak possibilities is also increased.

Using a storage system of ammonia, the nonflammable liquid or vapor can be safely piped to a dissociator in the vicinity of the furnaces and the hydrogen produced is in controlled quantities, under low pressure and usually in short runs of pipe to the point of use.

As anhydrous ammonia is stored in the liquid phase rather than in a gaseous state a considerably smaller storage area is required than is necessary with hydrogen gas or nitrogen gas. It can be put through a dissociator as shown in Fig. 1 to crack ammonia into 75% hydrogen and 25% nitrogen by volume. This method of producing hydrogen and nitrogen is both convenient and economical. A standard cylinder containing 100 lbs of anhydrous ammonia will yield 4,500 cu. ft. of gas containing 3400 cu. ft. of hydrogen, the equivalent of that contained in 17 cylinders of hydrogen. The remaining nitrogen being a neutral gas has no deliterious effects on the metal being treated. The following cost comparisons illustrate the economy of such a system.

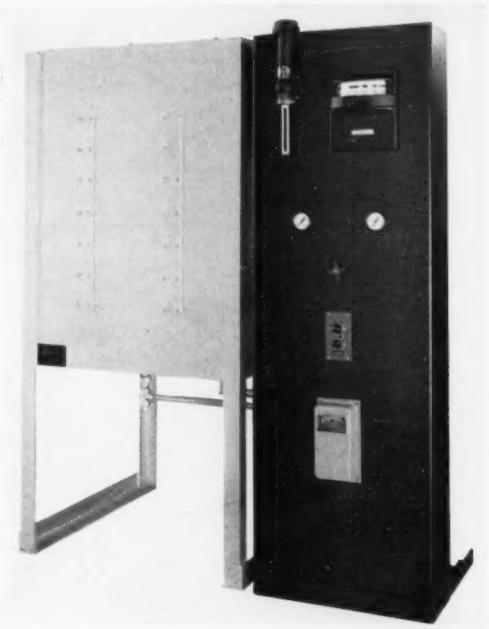


Fig. 1—A typical ammonia dissociator for the preparation of controlled atmospheres.

	HYDROGEN	AMMONIA	REMARKS
Delivered base price	$2.00 per cyl	$18.50 per cyl	
Volume per cylinder	200 cu. ft.	4500 cu. ft.	After dissociation
Equivalent number of cyls	23	1	
Handling labor (5¢/cyl)	$1.15	$.05	
Storage cost (4¢/cyl)	.92	.04	
Handling labor/100 cu. ft	.025	.001	
Storage cost/100 cu. ft.	.020	.001	
Cost of product/100 cu. ft.	1.00	.410	
Cost of equipment/100 cu. ft.	—	.125*	Amortized in 3 yrs
Cost of electric power/100 cu. ft.	—	.060	
Total cost/100 cu. ft.	$1.045	$.597	
Savings in operation/100 cu. ft.		.448	

Percentage savings in operation cost—44%
and after equip. is amortized savings are—55%

***This figure arrived at by the following assumption:**
500 cu. ft. per hour dissociator costs approximately $4500 installed. Assume equipment to be completely amortized in 3 years, then amortized cost of equipment equals $.125 per 100 cu. ft.

If it is the desire for a complete nitrogen atmos-

phere, the cracked gas can be burned in a properly designed combustion furnace with the required amount of air to yield nitrogen and water vapor. This type unit is shown in Fig. 2. 100 lbs of ammonia so treated will yield 7800 cu. ft. of nitrogen, an amount equal to that contained in 39 cylinders of nitrogen. The following cost comparison of anhydrous ammonia with nitrogen speaks for the economy of this operation not only in basic material cost but savings in labor.

Fig. 2—A generator developed for the production of nitrogen with a controllable hydrogen content; the "Nitroneal Generator."

	NITROGEN	AMMONIA	REMARKS
Delivered base price	$2.40 per cyl	$18.50 per cyl	
Equivalent gas volume	200 cu. ft./cyl	7800 cu. ft./cyl	After generator
Equivalent number of cyls	39	1	
Handling labor (5¢ per cyl)	$1.95	$ .05	
Handling labor/100 cu. ft.	.025	.001	
Product cost/100 cu. ft.	1.200	.236	
Cost of equipment/100 cu. ft.	—	.278*	Amortized in 3 yrs
Cost of electric power per 100 cu. ft.	—	.001	
Total cost/100 cu. ft.	1.225	.516	
Savings in operation/100 cu. ft.		.709 or	58%
Savings in operation after third year per 100 cu. ft.		.987 or	80%

*This figure arrived at by the following assumption—500 cu. ft. per hour nitrogen generator costs $10,000. Assume 8 hr day, 300 day year at 500 cu. ft./hr = 1,200,000 cu. ft.

$\frac{10{,}000 \div 1{,}200{,}000}{100 \text{ cu. ft.}} = .833$ per 100 cu. ft./yr. or .278/100 cu. ft. in 3 years

To further clarify the savings by changing over to NH_3, a chart has been prepared on which is plotted the delivered cost of hydrogen based upon Fig. 3, a cost of $1.00 per 100 cu. ft. plus 4½¢ per hundred cu. ft. required for cylinder handling and storage. This appears as a straight line. The curve indicates the total cost of the dissociated ammonia per 100 cu. ft. including amortization of the dissociating equipment on a 3 year basis plus electric power for operating the unit. The abcissa of this chart indicates quantities of gas used per hour.

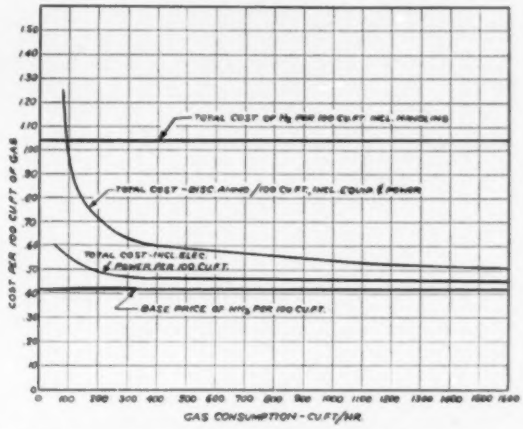


Fig. 3—Cost comparisons between Hydrogen and Ammonia.

From the chart it is apparent that with atmosphere in excess of 90 cu. ft. per hour average usage, sufficient savings are realized in operating costs by using dissociated ammonia, to pay for the equipment in 3 years, and when the equipment is amortized, in this short period, operation costs will be cut more than 50%.

STORAGE METHODS

Anhydrous ammonia is distributed by: 1. cylinder, 2. bulk truck deliveries, and 3. rail tank cars. Certain advantages are offered by each system of storage.

Cylinder Storage: Many small heat treating plants will store cylinders of NH_3 and manifold them together for their load requirements as seen in Fig. 4. Using this method, the ammonia is de-

(Continued on page 42)

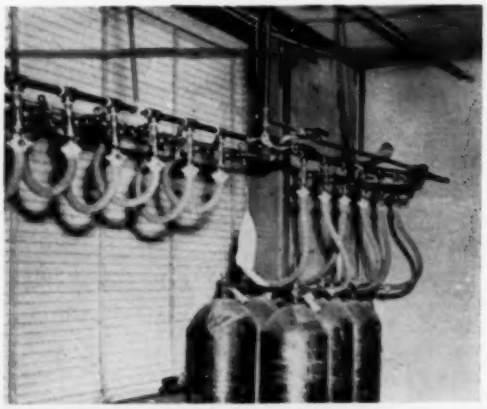


Fig. 4—A typical cylinder storage installation.

MTI NEWS TO HEAT TREATERS...

New Motor Generator Unit

A new motor generator control and heating station incorporating many new features has been designed by Lindberg Engineering Company, 2444 W. Hubbard St., Chicago, Ill., for forging, hardening, brazing or annealing operations where deep penetration of heating is desired. Motor generator sets with frequency cycles of 960, 3000 or 9600 and power inputs ranging from 50 KW to 1250 KW for use with the new station are available for the first time from Lindberg.

The station has been designed to enable metering to be located on either the front, right or left side. The meters can thusly be

placed where the operator can easily see them regardless of where it is necessary to place accessory equipment.

The output transformer can be installed or removed through either the front or rear of the station. The output transformer busses can be either vertically or horizontally oriented to accommodate different types of work coils.

A supervisory system of "Checklites" maintains a constant check on air temperature, water temperature, high voltage interlocks, water flow and other operating conditions of both motor generator and work stations. The lights instantly reveal abnormal conditions at any of the many protective devices.

Operations may be timed automatically by means of a four-circuit synchronous timer capable of controlling three operations in addition to the heat cycle. Vernier adjustments are furnished on the first three positions for accurate heat, quench and capacitor contactor.

MTI to Offer Achievement Award

On October 31st, at its Annual Meeting in Chicago, Ill., the Metal Treating Institute will offer its first *Annual Achievement Award*.

Presentation of this Award was initiated during the 1953 Institute meeting. It is designed to offer a measure of recognition and appreciation to those individuals who have prepared articles for *Metal Treating*, the Institute Journal, or who have presented talks before regular meetings of the Institute. The award is open to everyone and is not in any way intended for Institute members only.

The first award will be presented for the best paper or lecture given during the period of October, 1953 to September, 1954. The winner of this year's award has not yet been announced.

Rust Converter

Municipal Steel Corporation, Chemical Division, 1225 Broadway, N. Y. 1, N. Y., announces the availability of FerRoSeal, a liquid which chemically converts rust into a protective iron phosphate coating. New to America, this product is said to be the only cold phosphating treatment for rusted iron and steel. FerRoSeal is a patented process and the registered trade name for one of the products developed by the Walterisation Co., Ltd., of Croyden, England.

According to the distributor, a rusted surface treated with FerRoSeal is a better base for paint or coatings than clean, bright steel, because chemists and engineers admit iron phosphate to be the best known such base. It is claimed that this process eliminates the need for sand or shot blasting, or acid pickling, and requires only the wire brushing off of scale and loose rust. Subsequent water rinsing is also said to be unnecessary because there are no harmful chemicals in FerRoSeal which must be washed off.

New Endothermic Gas Generators

A new endothermic gas generator for controlled atmosphere furnaces, having 1250 C.F.H. output capacity, has been designed and is now being manufactured by Ipsen Industries, Inc. Rockford, Illinois.

Atmospheric air and raw gas are drawn through flow meters, accurately proportioned, and pumped into a catalytic cracking retort heated with efficient multiple jet burners. As soon as completely cracked in the heating chamber, the gases are cooled by a water jacketed heat exchanger. This produces an endothermic gas of constant analysis, enabling closer control. Natural gas, butane, propane, and certain manufactured gases can be processed with the unit.

Several safety features are provided including an automatic fire-check in the event the operating gas pressure falls below normal, and a gold fuse and thermocouple to assure operation within a safe temperature range. Two exhaust vents at the top provide

(Continued on page 16)

Whips the Radiant Tube Problem

Fabricated Inconel averages nine months' longer service in comparative tests of radiant W-tubes for roller hearth bright annealer

What life can you get from fabricated Inconel radiant tubes? The figures at the right speak for themselves. But here's a bit more on the service conditions.

The place: a large steel company. *The work:* bright annealing steel tubing. *The atmosphere:* slightly reducing. *The temperature:* 1725° (much higher in tube firing leg.) *The fabrication:* designed, formed and welded by Brown-Hutchinson Iron Works, Detroit 11, Michigan.

Perhaps Inconel would improve furnace equipment life in your plant, too. This high strength alloy is remarkably resistant to oxidation at high temperatures and to corrosive furnace atmospheres. It lends itself to a wide variety of designs and is readily fabricated.

To further explore Inconel's possibilities, write Inco for a copy of "Keep Costs Down — When Temperatures Go Up." It tells where, when, and why Inconel solves high temperature metal problems.

REPORT ON LIFE OF "W"-TYPE RADIANT FIRING TUBES

Number of Tube	Location in Furnace	Wall Gage	Life Record of Previous Tube	INCONEL	Condition at End of Test
1	No. 2 Furnace N.S. No. 5, Top	.125	24 months	38 months	Still OK
2	No. 2 Furnace N.S. No. 6, Top	.095	10 months	Failed after 36 months	Removed
3	No. 4 Furnace S.S. No. 9, Top	.125	20 months	38 months	Still OK
4	No. 4 Furnace N.S. No. 5, Top	.125	25 months	33 months	Still OK
5	No. 4 Furnace N.S. No. 7, Top	.095	26 months	Accidentally damaged at 11th month	Scrapped
6	No. 4 Furnace S.S. No. 10, Top	.125	29 months	31 months	Still OK
7	No. 4 Furnace N.S. No. 6, Top	.125	23 months	Failed after 31 months	Removed

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys

Inconel **Incoloy** . . . for long life at high temperatures

News to Heat Treaters (cont.)

for efficient removal of combusted fuel gas. A water-cooled heat exchanger cools the endothermic gas as it leaves the generator, eliminating carbon deposition.

New Quality Control Manager at Carboloy

Robert A. Canning, formerly manager of production engineering, Carboloy Department of General Electric Company, has been named manager of quality control.

Canning will be responsible for all quality control and inspection activities carried on in both the Detroit and Edmore, Mich., plants of the Department.

Previous to joining Carboloy Department in 1946 Canning was affiliated with the American Steel and Wire Co., Worcester, Mass., A. F. Holden Co., New Haven, Conn., and Acme Heat Treating Co., Worcester, Mass.

Hot Salt or Hot Oil Quenching Unit

A new gas fired hot salt or hot oil quenching unit is being introduced by Industrial Heating Equipment Co., 3570 Fremont Pl., Detroit 7, Mich. The unit is designed to operate in the range between 300 and 800° F., depending upon the selection of oil or salt. The container is heated

by recirculation of hot air around all the surfaces of the pot, including the bottom.

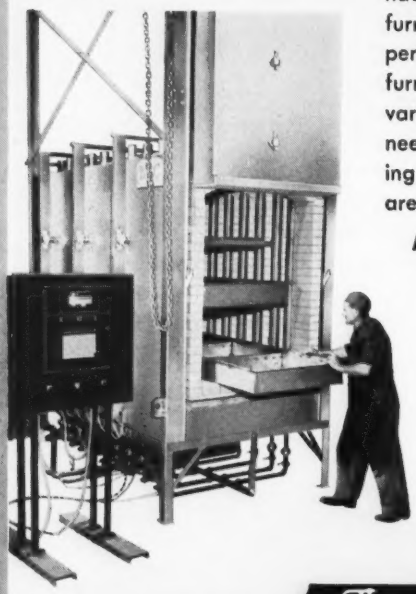
The temperature of the salt or oil is maintained by a close temperature control arrangement.. If the salt or oil rises above desired operating temperature, the gas is shut off and cold air is admixed to the circulating gases to reduce the temperature. When the salt or oil drops below the desired temperature the gas comes back on.

Agitation is provided by a propeller immersed in one section of the pot, with the duct work so constructed within the container that in the quenching area the closest approach to uniform but controllable velocity of the flow of the quenching medium is said to be reached.

The unit may also be equipped with a filter for removal of any high temperature salt carry-over, that is, salt that may adhere to the work. Hardening salt will freeze when it hits the hot salt or oil quench, and must be removed in order to preserve the efficiency of a hot salt quench.

(Continued on page 18)

Furnaces designed and built FOR SPECIAL PROBLEMS



• Don't try to solve your furnace problem with a "problem furnace"! With years of experience successfully meeting furnace problems for a wide variety of industries, our engineers are right at home solving unusual problems. What are yours?

A unique sintering furnace

Operates at 1300° F.—Uses atmospheric type gas burners firing upward thru radiant tubes. Charge is loaded into trays and rolled into furnace at three levels.—Conditions required stainless steel tubes, trays, and rollers.—Equipped with recording temperature control, and combustion safeguards.

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American Steel Prod. Co.
2828 Lyndale Ave. South

OAKLAND
Russo Foundry Equip. Co.
3882 Fairway Ave.

OMAHA
Fuchs Mach. & Supply Co.
2401 No. 11th St.

PITTSBURGH
John E. Finger Co.
1123 La Clair Ave.

ST. LOUIS
Shea-Brownell Co.
3903 Olive Street

The Park Neutra-gas Story:

No sludge, no de-carb in neutral salt baths rectified by Park's patented process!*

A patented development of Park's research laboratory, the Neutra-gas process efficiently and economically neutralizes chloride base salt baths . . . maintaining them free of de-carb in temperatures ranging from 1350°F. to 2300°F. The decarburizing oxides present are chemically converted back to chlorides by passing methyl chloride through the molten baths.

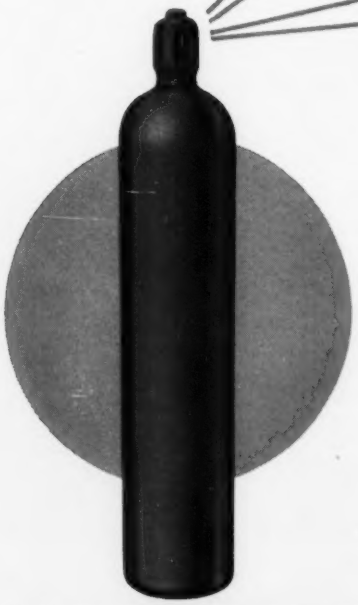
No solid rectifiers and their subsequent sludging are needed. No fresh salt additions are required except to replace drag-out. Fluidity of salt is maintained like new and sluggishness caused by solid rectifiers is eliminated.

Complete details of the Neutra-gas process plus valuable information on neutral salt baths, their operations and uses, are described in a technical bulletin available to you by mailing the attached coupon.

* Truly neutral chemically. Alkalinity can be maintained at zero.

At Commercial Steel Treating Corp., in Detroit, salt bath furnaces are daily cleansed of all impurities. Rectifying gas is bubbled into Park Nu-Sal Neutral Salt molten at its operating temperature of 1500°F.

Even high-speed hardening baths up to 2300°F. are easily maintained neutral. At Commercial, both pre-heat and high heat are rectified daily to zero alkalinity. Rectification is at 1850°F. in the high heat, done either on idling time or when furnaces are being used for hardening high carbon, high chrome die steels. Salt is Park Pre-heat 117, and Park High Heat 175-S.



Methyl Chloride (CH_3Cl) is a liquefied gas, 99.98% pure (by weight).
Patent number—2474680—Neutra-gas Process license fee, $25.00 per year.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

Park

PARK CHEMICAL CO.

8076 Military Avenue • Detroit 4, Michigan

Send free bulletin on Park Neutra-gas Process.

Name_____ Position_____

Company_____

Address_____

City_____ State_____

News to Heat Treaters (cont.)

New Ass't Chief Metallurgist at Amer. Brake Shoe

Robert J. Ely has been appointed assistant chief metallurgist for the American Brake Shoe Company. Formerly process metallurgist, Mr. Ely joined the company in 1945. He is a gratuate of M. I. T. and is located at the company's Research Center in Mahwah, N. J.

Ceramic Coatings

That the life of exhaust systems and parts subject to high temperatures can now be increased from three to five times through the application of high temperature ceramic coatings in such areas as automotive, trucking, marine and heating equipment, is the claim of the Bettinger Corporation, Waltham, Massachusetts.

This new development has reportedly been made possible by coating the entire part, both inside and out, with a 0.001 to 0.002 inch thick high temperature ceramic coating, which resists corroding gases and withstands extreme operating temperatures up to a range of 2200° F.

"Based on the successful completion of laboratory work and a series of pilot projects," Mr. Robert A. Weaver Jr., President of Bettinger stated, "we are convinced that this advance in the technology of high temperature ceramic coatings will be as successful as our continuing work with the 'hot parts' of jet engines, which began in late 1951."

LOAD & METER

100 to 5000 pounds per hour

A new "Metering Loader" will meter any small pieces ranging from "BB" Shot to Washers, Buttons, Bolts and Bowling Pins.

These parts can be loaded at any rate between 100 to 5000 pounds per hour through the use of a variable speed drive, 20 to 1 variation obtainable.

This loader can be made to distribute the work evenly across the full width of the conveying mechanism in the appliance being fed.

It will handle parts as small as 1/16" thickness or diameter.

The standard hopper, which empties itself, holds up to 1000 pounds of average size bolts weighing approximately 200 pounds per cubic foot.

The "Metering Loader" can be built to meet special conditions. It may also be used as an elevator only.

ECONOMY in—Initial Cost, Floor Space Required, Installation and Operation are engineered into the Industrial Heating Equipment Co. "Metering Loader."

Write Today for Details

SEE UNIT IN OPERATION AT THE METAL SHOW—BOOTH 1755

INDUSTRIAL HEATING EQUIPT. CO.

3570 FREMONT PLACE • DETROIT 7, MICHIGAN

Park Chemical President

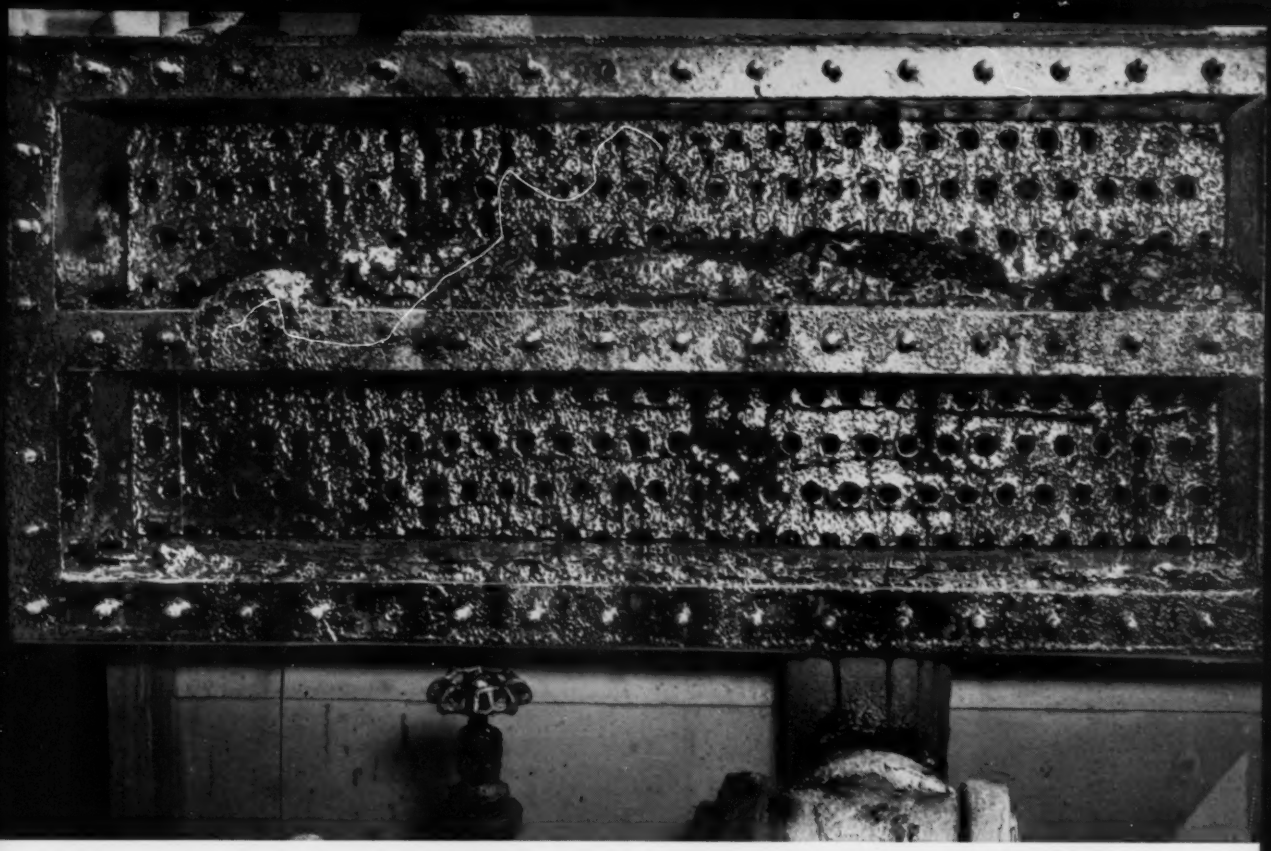
F. Lloyd Woodside, 58,, president of Park Chemical Co., 8074 Military, Detroit, Mich., died August 9. He had been president of the company since 1942, and before that time was associated with the following companies: Studebaker Corp. 1911-1924, Craine Schrage Steel Co. 1924-1929, Ludlum Steel Co. 1929-1935 and Climax Molybdenum Co. 1935-1942. He was a brother of W. P. Woodside, Chairman of the board of Park Chemical Co.

World's Largest Plate Treating Line

The Drever Company of Philadelphia has recently received an order for a plate heat treating line for hardening, tempering and normalizing plate to be installed at the Lukens Steel Company as part of their present expansion program. This will be the largest continuous plate heat treating line in the world and will handle plates up to 172" wide x 3" thick x 480" long. To house this line, a new building is being erected and to obtain the necessary water supply for the quench, etc., a nearby stream is being diverted and a reservoir of 5,000,000 gallons capacity built.

The facilities consist of a 52 ft. long charging transfer car, 145 ft. long hardening roller-hearth fur-

(Continued on page 20)



If you use an ordinary quenching oil that forms sludge deposits, here's what can happen to your oil cooler.

SUN QUENCHING OIL LIGHT WON'T CLOG COOLERS

Sludge lowers operating efficiency, ups maintenance costs, cuts output. Sun Quenching Oil Light, when used at normal temperatures, keeps coolers clean, because it has a natural detergent action that prevents the formation of sludge deposits and aids in removing any deposits that have accumulated. And this oil thins out when heated—reduces drag-out, brings operating costs down. The booklet "Sun Quenching Oils" tells the story of Sun's money-saving quenching oils. Call a Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. MR-9.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

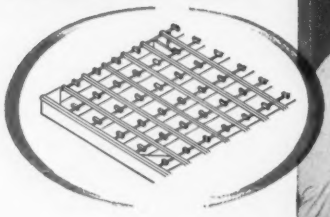
ROLOCK

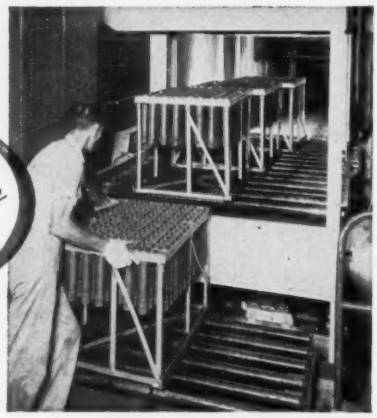
FABRICATED ALLOYS

HEAT AND CORROSION RESISTANT

UNIQUE RACK DESIGN WITHSTANDS

TOUGH HANDLING





. . . at Clayton & Lambert Plant

The Ordnance Division of this Louisville, Ky., plant uses Rolock fabricated Inconel racks for transporting steel shell cases thru a wash, pickle, rinse and taper lubricant application, prior to final tapering operations. The 33⅞" x 24¼" wide top of the rack provides square spaces for inserting a 175-lb. load of 96-40MM cases, suspended mouth-down on the case flange (see drawing above). Solution temperatures are 160° to 180° F., and an alternate cycle includes annealing thru a gas-fired furnace at 725° to 750° F.

The user states that "the racks get quite a bit of rough handling." Well, what Rolock does is to design and fabricate equipment to stand up under "rough handling" . . . to meet the exposures required in heat treating and processing operations . . . and provide longer work-hours to reduce unit costs.

We offer you Catalogs B-8 and B-9 with up-to-the-minute information valuable to your heat treating and metal processing departments. Copies on request.

See Rolock at Booth 1724, Metal Show, November 1-5, Chicago, Ill.

SALES AND SERVICE REPRESENTATIVES FROM COAST TO COAST

ROLOCK INC. • 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

7RL54B

News to Heat Treaters (cont.)

nace, 10 ft. long transfer table, 45 ft. long 2500 ton pressure quench, 52 ft. long transfer car, 200 ft. long by-pass conveyor table, 52 ft. long transfer car, 200 ft. long tempering roller-hearth furnace. Additional facilities include a wider 200 ft. long conveyor table and 52 ft. long transfer car to serve the customer's 200" roller leveler and an additional by-pass conveyor for the 200 ft.. furnace. All conveyor rolls, furnace doors and transfer cars will be motor operated and controlled by one man from a control house located adjacent to the quench press.

The temperature range of this line will be 750 to 1650°F and heat treating cycles will be variable to accommodate the wide variety of plates for which the line is intended. Rated capacity is 9 tons/hour of net size plate and maximum capacity is 19.2 tons/hour net plate. Special provision is being made for quick roll removal and replacement in design of the furnace casing and roll drive.

The 200 ft. furnace is designed for reversible heating so that, when normalizing plate, the furnace may be charged from either end. When processing armor plate, it will be used in one direction only and towards the quench press end.

The furnaces will be direct fired with combination natural gas or oil tempered flame burners. Control panels will be located in a control room adjacent to the operator's room.

The pressure quench will have an effective bed 15 ft. wide x 43 ft. long and a maximum pressure of 2500 tons. Quench water will

(Continued on page 22)

LP GAS INSTALLATIONS and ANHYDROUS AMMONIA PLANTS

More than 80 Peacock Plants prove . . .
"There's No Substitute For Experience"

PEACOCK CORPORATION
Box 268, Westfield, N. J.
Westfield 2-6258

heat after heat

YOU CAN BANK ON HOUGHTO-QUENCH FOR UNIFORM QUENCHING RESULTS

When you must be *sure*, get the *safest* quench

When *speed* is needed, get the *fastest* quench this side of water.

When *uniformity* is essential, get the quench that's fortified for high *stability*.

You needn't use several quenching oils—HOUGHTO-QUENCH gives you all you want.

Ask the Houghton Man to show you why our Houghto-Quench gives you the speed and hardening safety you want—with lower cost per ton of steel quenched.

HOUGHTO-QUENCH

... a product of

QUENCHING HANDBOOK mailed on request. Address E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

be directed on the work by means of renewable spray pipes built into the upper and lower platens, fed by manifolds. Water control will be in six sections by means of air operated diaphragm control valve, push button operated from the control room. Maximum water consumption will be 24,000 gallons per minute at 45 to 60 PSI and furnished by three (3) 400-HP 8000 GPM pumps.

An electrical control center located below the operator's control room will contain all motor starters, the main circuit breaker and transformers for reducing line voltage for control power. Besides inter-phone communication between various parts of the line and/or the control room, two (2) television receivers in the control room with five (5) cameras placed strategically around the facilities are contemplated to give the operator full knowledge and vision of the work throughout the heat treating cycle.

Completion of this installation is scheduled for early spring of 1955. This line is in addition to the stainless plate heat treating line now being installed for the same customer which is scheduled for completion this fall.

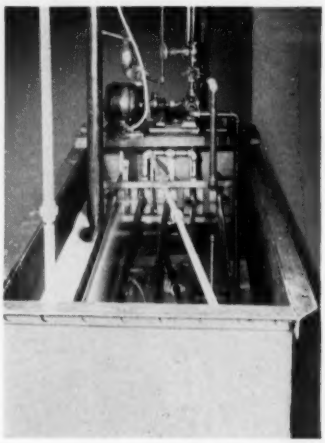
Tempil Exhibit

Tempil Corp., 132 W. 22nd St., New York 11, N. Y., will conduct live demonstrations of its products at the Metal Show.

Technicians will be on hand to illustrate and discuss the use of Tempilstiks and other Tempil products.

Heat Transfer Units at Metal Show

Platecoil Division, Tranter Mfg. Co., Lansing 4, Mich. will exhibit their versatile heat transfer units at the Metal Show, November 1 to 5. The units consist of two embossed sheets of steel or special alloys seam and spot welded together to provide channels for the passage of heating or cooling media. The units are



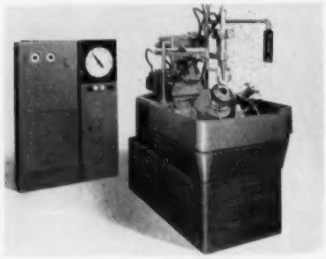
used in a wide variety of industrial applications and offer, according to the manufacturer, an economical method of controlling temperature in quench tanks, casting impregnant reservoirs, etc.

It is reported that one installation made for the K-D Manufacturing Co., Lancaster, Pa., was made for one-third the cost of a conventional heat-exchanger and has proved completely satisfactory. The installation, shown here, is used to quench out three hundred pounds of material per hour from 1600°F. to 140°F. Quench temperature is maintained at 110°F. with a flow of 75°F. cooling water at 6 GPM.

New Electronic Mechanism Controls Surface Hardening of Gear Teeth

A sensitive electronic control is featured on the new and improved models of Gleason gear surface hardeners, produced by Gleason Works, 100 University Ave. Rochester, New York. The Gleason No. 1 gear surface hardener will be exhibited at the Metal Show, November 1-5.

On these machines oxy-acetylene flames traverse each individual tooth separately. A sensitive radiation pyrometer is focused directly on the tooth being heated, and receives radiant energy from the hot metal. An electronic balancing mechanism translates that energy into forces which control the travel of the burners along the tooth. Operation of the machines is entirely automatic, after the optimum



hardening temperature is pre-set by the operator, and the machine is started.

Thus, it is said, heating to the correct hardening temperature, and uniform hardening of all teeth on a gear, and of all gears in a lot, are assured.

In normal operation, the machines are indexed so that the teeth hardened successively are non-adjacent. This reportedly eliminates the possibility of a change in bore diameter during hardening. The self-quenching nature of this method minimizes internal stresses. However, the surface hardeners are arranged to use water or oil quenching if desired, and adjustments are provided so that streams of coolant can be directed as close to or as far from the heating point as desired. Where coarse pitch teeth are being hardened, special burners with cooling orifices can be used.

Degreasing Tank

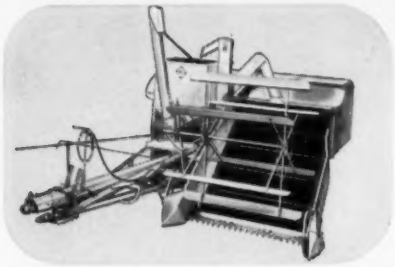
A new vapor degreasing tank is now being marketed by the Bacon Vulcanizer Co., 1205 67th St., Oakland 8, Calif. The unit requires a small amount of shop space, being 40" high by 22" diameter. It is electrically operated and reaches full vapor level with-

(Continued on page 28)

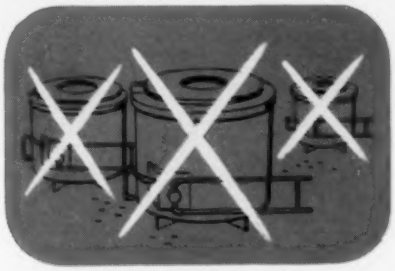
"Cyanide pots scratched . . . *LINDBERG* Carbonitriding Furnaces win in a walk!"

1. Owner, Allis-Chalmers, internationally known maker of farm machinery.

2. Allis-Chalmers purchased 3 Lindberg Carbonitriding Furnaces for its La Porte Works.



3. Furnaces used to heat-treat farm machinery parts—from a few ounces to 5 pounds.

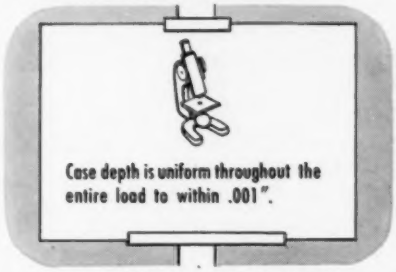


4. Old salt pots did not provide needed volume or desired uniformity of case depth.

WITH *LINDBERG* CARBONITRIDING FURNACES

One man does 5 times more than with salt pots.

5. This factor represents a tangible, specific saving in operating and labor costs.

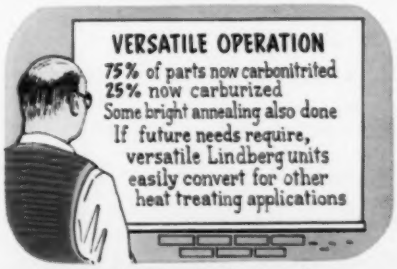


6. In addition to this advantage, working conditions were substantially improved.

NO SHOT BLASTING COST NOW

to remove frozen salt from fine threads tapped in parts . . . costly . . . high scrap rate.

7. Shot blasting eliminated . . . case depth requirements of .005 to .030 met.


VERSATILE OPERATION
75% of parts now carbonitrited
25% now carburized
Some bright annealing also done
If future needs require, versatile Lindberg units easily convert for other heat treating applications

8. Neutral hardening, carbon correction, tool treating—done with simple switch-over.

HOW ABOUT *YOUR* PLANT?

Perhaps we can help solve a production problem that will increase output, improve working conditions, and cut costs in your plant, too.

Write for our Bulletin No. 241.

LINDBERG *FURNACES*

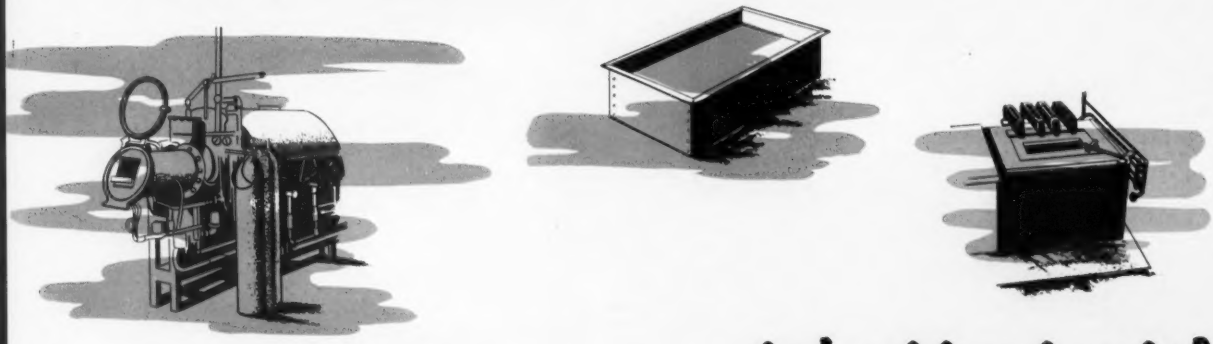
LINDBERG ENGINEERING COMPANY

2466 W. Hubbard Street • Chicago 12, Illinois

it takes more than these

. . . to build a bridge

it takes more than these



. . to heat treat metals

Both Must Have The Vital Ingredients — Skill and Experience

It is a sad fact that many skilled production men and managers have been, in recent years, badly misled into believing that given a furnace — a quench tank — a salt bath, and a corner of floor space — they can promptly and easily fulfill their heat treating requirements. Aggressive and misleading selling by some furnace and equipment manufacturers (fortunately only a small minority) has encouraged this misconception that equipment and materials alone are the essential factors in heat treating operations.

The cold fact is, that without the proper combination of human operational skill and technical knowledge developed over **years** of practical experience, even the best, most mechanical, most modern heat treating equipment becomes a potent menace to your product and your profit margin.

Careful evaluation of **all** the factors involved in any heat treating operation — large or small — always reveals that TECHNICAL SKILL BORN OF EXPERIENCE tops the list.

Make it head **your** list when you are analyzing the pros and cons of the question "Shall we do our own heat treating?" Write for a useful folder — "Facts and Figures on Heat Treating Costs".

If you are faced with heat treating problems or the need for heat treating services write

METAL

271 NO

For the BEST in Heat Treating Consult these Companies:

ALABAMA

Southern Metal Treating Co., Inc.
3131 10th Ave., North, Birmingham 4

CALIFORNIA

Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Malloy Heat Treating Co.
11648 So. Atlantic, Lynwood
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8
Valley Metal Treating Co.
355 So. East End Ave., Pomona

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Seneeca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
Lindberg Steel Treating Co.
1975 No. Ruby St., Melrose Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
American Metal Processing Co.
12000 East Nine Mile Road, Van Dyke

MINNESOTA

Metallurgical, Inc.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and IaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark
Temperature Processing Inc.
228 River Road, North Arlington
Metro Heat Treat Corp.
9 Victoria Place, Ridgefield

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E., Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave.,
Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Allied Metal Treating Corp.
Highway K & 60th Street, Kenosha
Hushek Metal Processing Co.
1536-40 West Pierce Street, Milwaukee 4
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4140 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Heat Treating Co.
1333 West Pierce Street, Milwaukee 4
Wesley Steel Treating Co.
1301-1103 West Pierce St., Milwaukee
Harris Metals Treating Co.
1635 Murray Ave., Racine
Spindler Metal Processing Co.
2338 Mead Street, Racine
Wesley Metal Treating Co.
2320 Mead Street, Racine

REATING INSTITUTE

MTI
MASTER CRAFTSMEN
METAL TREATING INSTITUTE

AVENUE · NEW ROCHELLE, N. Y.

INSTITUTE NEWS

Final Arrangements—Fall Meeting

On Tuesday, September 14th, President Cliff Cook and Secretary Herington met with the Chicago-Milwaukee Chapter committee in charge of social arrangements for the Fall Meeting. Present were Chairman P. C. Shaner, Senecca Heat Treating Co., L. A. Lindberg, Lindberg Steel Treating Co., A. L. DeHart, Fred A. Snow Co., B. Davis, Perfection Tool & Metal Heat Treating Co.

The Committee has made excellent arrangements for a Mid-West Chapter Hospitality Suite and for a complete ladies activities program.

Later, Wm. S. Cwik reported special arrangements have been made with the Hotel Sheraton for a separate registration booth in the Hotel and immediate room allotment to incoming members.

On Wednesday, September 15th, President Cook and Secretary Herington met with the Milwaukee group for a social evening, dinner and a final discussion of Fall Meeting plans. Present were C. I. Wesley, Wesley Steel Treating Co., R. E. Thurner, Thurner Heat Treating Co., C. F. Graham, Metal Treating Inc., and L. F. Klein, Supreme Metal Treating Co.

PROGRAM

1954 ANNUAL MEETING
Metal Treating Institute

Hotel Sheraton, Chicago, Illinois
October 29, 30, 31, 1954

FRIDAY
October 29, 1954

A.M.—LESLIE S. FLETCHER, Research Director, Research Fund, ASTE *"Possible Cooperation Between MTI and ASTE Research Fund to Establish Program Which Might Lead to Work of Mutual Benefit on Some Phase of Heat Treating Operations"*

P.M.—Plant Visit to Lindberg Steel Treating Company

SATURDAY
October 30, 1954

A.M.—C. B. POST, Chief Metallurgist, Carpenter Steel Co. *"How Steel Manufacturers and Commercial Heat Treaters Can Work Together To Their Mutual Benefit"*
"Productive Maintenance"—A New Motion Picture by General Electric Company. Two G. E. representatives will present the film, D. R. SIEWERT, Manager, G. E. Chicago Service Shop and H. E. SCARBROUGH, Heating Specialist, G. E. Central Division.

P.M.—A. T. RIDINGER, President, Metallurgical, Inc. and E. P. TANG, Touche, Niven, Bailey & Smart—*The Operation of a Profit Sharing Plan in a Commercial Heat Treating Plant"*

SUNDAY
October 31, 1954

A.M.—Business Meeting and Election of Officers
Presentation of First Annual MTI Achievement Award

P.M.—Meeting of the New Board of Trustees

6:00 P.M.—Reception and Banquet

Ferrotherm Holds Lecture Series

Over an eight-week period, Ferrotherm Co., Cleveland, O., held a series of lectures at its plant. During this time fifty-three companies sent 129 men to attend the meetings covering metal joining and controlled atmosphere heat treating.

R. G. Cameron, Ferrotherm Sales Manager, said this about the project, "The results of these talks have become very apparent to us in that the engineers who have attended have learned a little more fully about the art of metals joining. They have been able to design better than they had in the past, and they have definitely helped the heat treaters

One group of attendants at the Ferrotherm lecture series look over equipment during a plant tour.

in this respect. They have also learned the various processes which are involved with heat treating problems. They have seen at first hand, the furnaces which are used for the treatment of their parts, and our feeling is that it has been of unmeasurable benefit to both the companies we have talked to and to ourselves."

The program is again being conducted this fall and a number of the meetings scheduled have been booked to capacity.

Send for this new bulletin on

THERMALLOY* FURNACE CONVEYOR BELTS

See how design know-how

and modern foundry practices can produce high alloy

conveyor belts that last longer in heat treating operations

In this new bulletin you will see how Electro-Alloys engineers started with certain design theories about high temperature conveyor belts . . . and how these ideas directed the production of heat-resistant Thermalloy castings. You will see the importance attached to precision assembly of these castings into Thermalloy Conveyor Belts.

Finally, you will be interested to know that Electro-Alloys has established unique testing procedures that will give you a good indication of what can be expected from Thermalloy Conveyor Belts in operation. These results are shown in a composite load curve chart in the bulletin. And, Electro-Alloys engineers can apply these results to your installation . . . so you can get longer service life from Thermalloy Conveyor Belts in your heat treating furnaces.

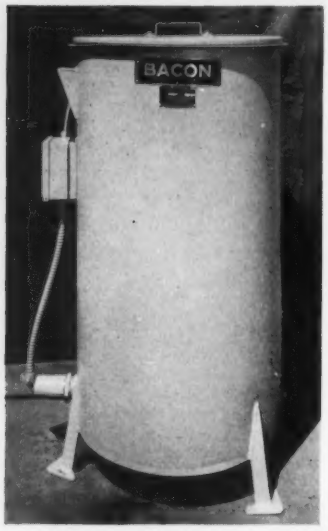
Start planning now to use Thermalloy Conveyor Belts to lower operating costs. Write for your free copy of Bulletin T-241 . . . Electro-Alloys Division, 5003 Taylor Street, Elyria, Ohio.

AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION

Elyria, Ohio

*Reg. U. S. Pat. Off.



in fifteen minutes, according to the manufacturer. Vapor level is controlled by a themostat and relay circuit which keeps it within 4" of the top of the tank.

"Package" Vacuum Metallizer

A new "package" vacuum metallizer, designed to meet the needs of firms with moderate production requirements, has been introduced by the F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia, Pa.

The new model 428 metallizer has a chamber 36 in. in diameter and 60 in. long. The 428 is a simplified unit, stripped of some of the more elaborate automatic features of the larger metallizers,

and is intended to bring vacuum metallizing economically within the reach of firms whose present volume would not justify the larger units.

The new vacuum-coating unit has an integral vacuum pumping system, consisting of oil diffusion pump and rotary mechanical fore-pump, which will bring the chamber down to the metallizing pressure of 0.5 micron in about 10 minutes. A console-type control panel groups in one convenient place all push buttons, starters, vacuum gages, rheostats, etc.

President of General Mfg. Co.

Harold F. Marsh has been elected president of the General Manufacturing Company, Detroit 11, Mich. F. C. Hossie, founder and designer of "Flexible Power Presses," was elected secretary.

(Continued on page 32)

BLACK MAGIC

Reg. Trade Mark

THE NAME THAT STANDS OUT IN BLACK OXIDE FINISHES

TROUBLE-FREE • ECONOMICAL • ATTRACTIVE

Type A Blackening Process For Steel

Improves Your Product
Increases Production
Cuts Costs

- One Bath -- One Salt
- Lower Operating Temperature
- Self Rectifying
- Faster Blackening Cycle
- More Corrosion Resistant

Mitchell-Bradford

Also Black Magic Blackening Processes for other ferrous and non-ferrous metals; metal cleaners, rustproofing oils and waxes, plating specialties and a complete line of heat treating salts.

THE MITCHELL-BRADFORD CHEMICAL CO.
2445 Main St. Stratford, Conn.

QUALITY PRODUCTS OF CHEMICAL RESEARCH

one stands out

...and REX is the standard by which all high speed steels are compared

It takes exceptional skill *and* experience to make consistent scores on the target range . . . or to produce consistently superior high speed steels.

Crucible has been making REX® High Speed Steels for over half a century . . . and REX is still the standard of comparison wherever high speed steels are used. That's no idle claim . . . and you can prove REX's superiority for yourself by putting a piece to work in your own shop. You'll like its hardenability, response to heat treatment, and good tool performance.

Once you've tried it, we think you'll agree — *you can't find a high speed steel that will outperform REX.*

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

Service-Life:

"1,560 hrs!"

(1,272 pay hrs. and 288 idling hrs.)

Ad-Therm (Non-Alloy Steel) Neutral Salt Pot still serviceable after 1,560 hrs. (removal due to slow recovery, not a "leaker").

★ Ad-Therm metallurgy solves your salt pot problems! Metal treaters are re-ordering Ad-Therm Salt Pots because they *out-perform all others,* and cost *less.* They're fabricated (not cast) of a patented, special non alloy steel which, for the first time, offers the *ideal hi-heat and endurance characteristics* you've been looking for. Here is the right combination of *high thermal conductivity for efficient heating,* and *heavier wall thicknesses for longer life.* All standard sizes available. Engineered and manufactured by Advance Thermal Equipment Co., Cleveland, O.

SEND FOR COMPLETE DETAILS AND PRICE LIST
Sole Distributor

PARK CHEMICAL COMPANY

8074 Military Ave. **Detroit 4, Mich.**

Outside Heat Treating Facilities Can Cut Costs (cont'd)

naturally simplifies production scheduling. Even quicker service is given on emergency orders, which are delivered in the morning and picked up in the afternoon of the same day by company station wagon, or truck, if necessary.

Packaging is supervised by the inspection department to avoid any possibility of nicks or distortion in pieces being sent out for treatment.

Experimentation has proved that maximum efficiency can be achieved by scheduling runs on the basis of a 90-day supply of each item. In other words, as our inventory of one type and size of heat treated part begins to run low, we send out for treatment at one time enough pieces to meet anticipated demand for this part for the next three months.

Plating Arrangements

Whatever plating may be done on our heat treated items is handled by the same heat treating company. This obviously saves us the trouble of having to make up separate orders for plating work and waste time and effort in unnecessary extra handling.

An additional advantage of having heat treating and plating carried out in the same outside shop is the availability of additional finishing equipment there. For example our Rotocycle gears are given an exceptionally smooth finish on up-to-date fine rotary table sandblasting equipment.

Naturally the materials flow pattern between the two plants is complicated by the necessity of plating certain items before machining is completed. This is particularly true in the case of copper-plating, such as is performed on Rotocycle gears before final machining of the unplated teeth.

The copper plating, in this case, is applied primarily to prevent hardening of the rest of the gear, which would prevent it from being drilled, peened into position in the ball clutch, and so on.

Free Metallurgical Advice

In an arrangement such as ours, the consultation function of a good heat treating shop's highly trained metallurgical specialists can be easily extended at no extra cost beyond the bounds of simple heat treating and plating advice.

We have developed the habit of consulting regularly with the shop's metallurgists on problems involving selection of exactly the right material for specific applications.

All in all, we feel that the entire arrangement has worked out to our advantage all the way along the line. ■ ■ ■

A native and lifetime resident of Pittsburgh, Mr. Olson has been with Rockwell Manufacturing Company for 25 years. Starting as a machinist and later a foreman in the asssembly department at the Pittsburgh plant, he was made chief inspector in 1939 and superintendent of assembly in 1949.

Just off the press—

THE HOW AND WHY OF BETTER QUENCHING WITH GULF SUPER QUENCH

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Gentlemen:

Please send me, without obligation, a copy of your new 24-page brochure dealing with the application and advantages of Gulf Super-Quench.

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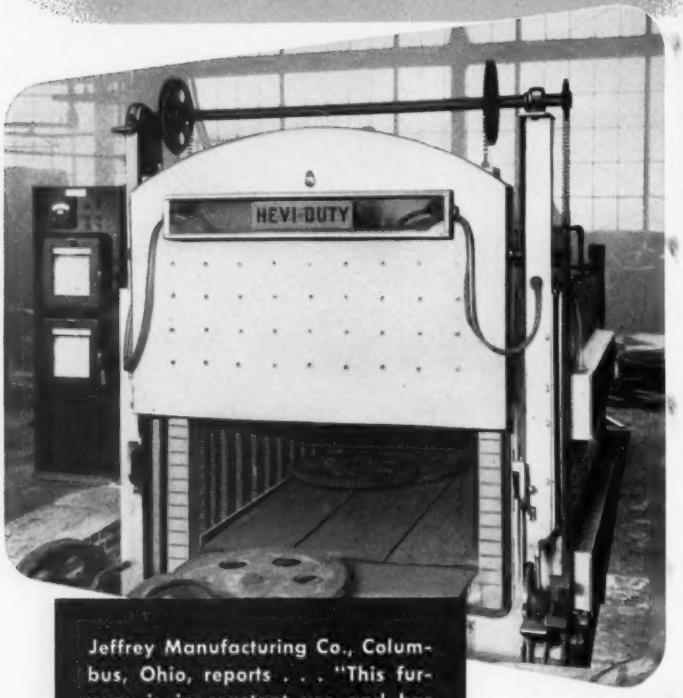
"Considerably Superior"

HEVI DUTY *Multi Range*
CONVECTION FURNACES

GIVE YOU A WIDE RANGE OF TEMPERATURES
WITH A HIGH DEGREE OF UNIFORMITY . . .



Jeffrey Manufacturing Co., Columbus, Ohio, reports . . . "This furnace is in constant use and has produced results considerably superior to those previously obtained."

This all-purpose furnace gives you temperature uniformity in the 400° to 1850° F. range. The Jeffrey Manufacturing Co. is using this multi range convection furnace installed at floor level for hardening and tempering operations on large parts, and occasionally for pack carburizing. They find it "considerably superior" for their type of operation. Bulletin HD 341 gives you all the details, types, sizes and specifications as well as special features. Write for your copy today!

HEVI DUTY

HEVI DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces... Electric Exclusively
Dry Type Transformers *Constant Current Regulators*

News to Heat Treaters (cont.)

Dow Exhibit At Metal Show

Dow Furnace Company, 12045 Woodbine Avenue, Detroit 28, Michigan will display their new M-400 furnace at the Chicago Metal Show. The M-400 is the smallest of Dow's three batch-type controlled atmosphere furnaces for gas carburizing, carbonitriding, clean hardening and carbon restoration.

Incorporated in the new M-400 are such features as sealed-cycle-operation which reduces the time between loads to less than 30 seconds and allows continuous operation. As a part of the Sealed Cycle feature all furnaces have forced quenching from atmosphere to give full hardness, reduce distortion, eliminate scale.

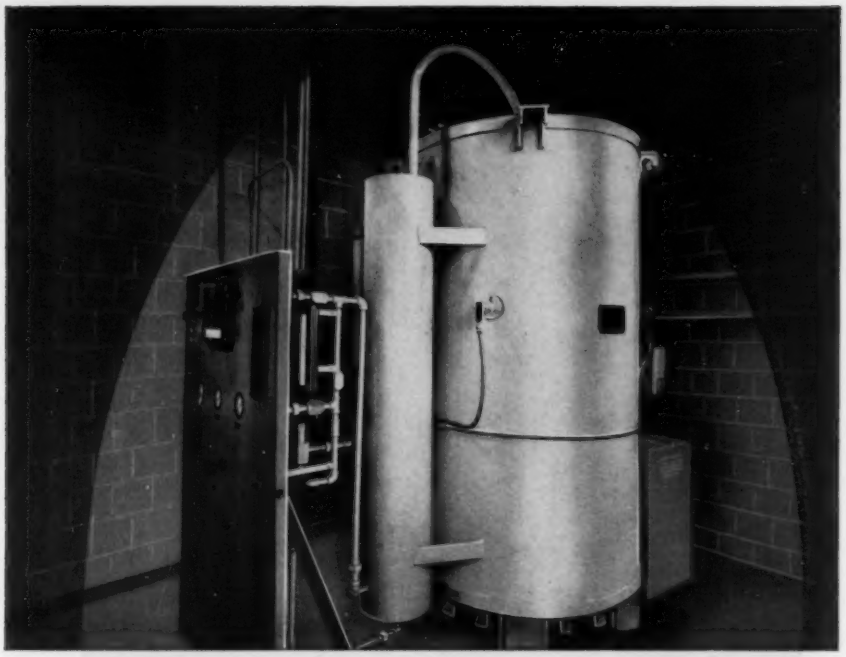
Three Special Sessions To Be Presented by Industrial Heating Equipment Association

Three practical panel sessions on furnace atmospheres, furnaces, and induction heating will be presented by the Industrial Heating Equipment Association (formerly the Industrial Furnace Manufacturers Ass'n.) under the auspices of the American Society for Metals during the National Metal Congress and Exposition in Chicago.

The preparation and control of furnace atmospheres, application of furnaces using prepared atmospheres, and induction heating will be covered in these three panel discussions, the first of which will be held Tuesday morning, November 2, at the Palmer House. The second and third will be presented Tuesday and Wednesday afternoons, November 2 and 3 at the International Amphitheatre. Following is the program:

Tuesday Morning, November 2, 1954
Session Held at the Palmer House

(Continued on page 34)



"Cracked" Ammonia shows tremendous cost saving and unsurpassed performance

1. —Bright Annealing—Stainless Steels, Nickel and Nickel Alloys, Beryllium Copper, Silicon Copper Alloys and Bronzes, and high and low carbon steels.
2. —Clean Hardening—High carbon and high chrome tool steels.
3. —Copper Brazing of all types of ferrous metals.
4. —Sintering of Powdered Metal Parts.
5. —Bright Annealing of Electrical Steels.
6. —Reduction of Metal Oxides.
7. —Atomic Hydrogen Welding.
8. —Radio Tube Sealing.

the Drever

Ammonia Dissociator

produces the ideal protective furnace atmosphere

DREVER COMPANY

We can supply COMPLETE STORAGE SYSTEMS for tank car lots of anhydrous ammonia. This reduces the cost of ammonia approximately 75%. *Write for bulletin B-52*

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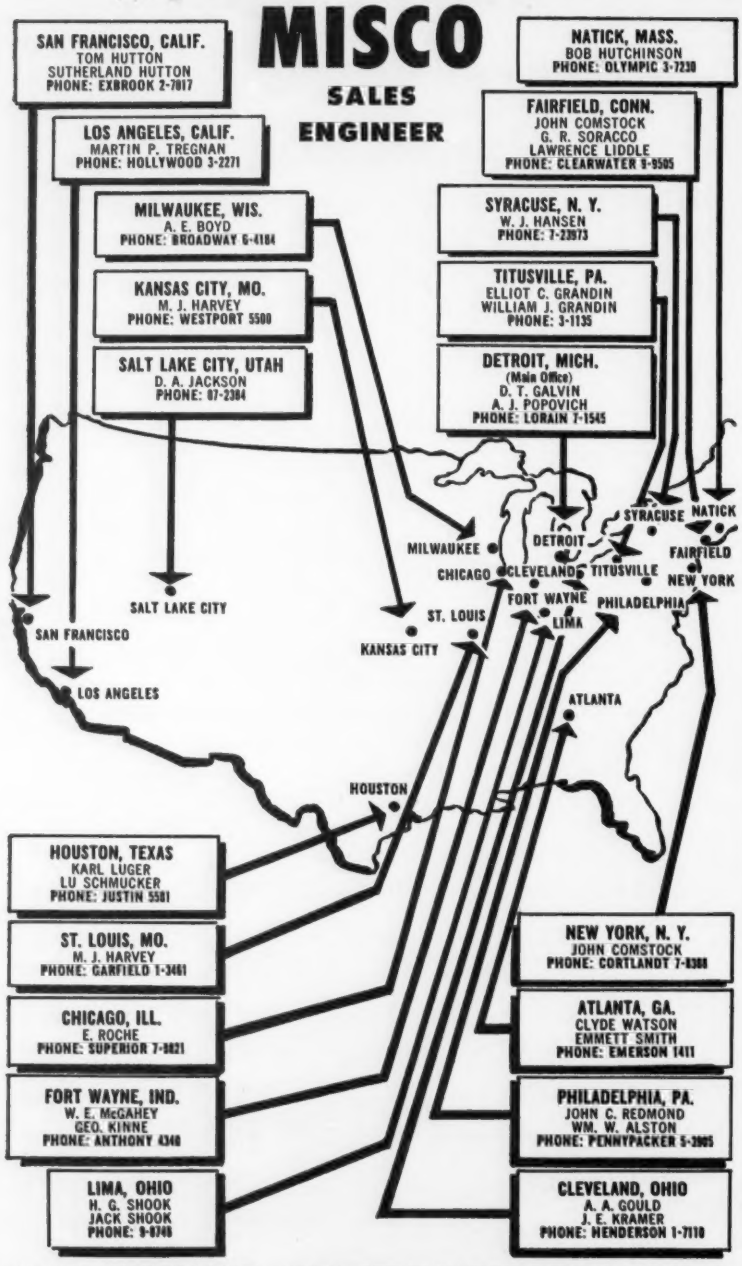
HELP Yourself

GET THE BEST IN HEAT AND CORROSION-RESISTING EQUIPMENT

PHONE *THE NEAREST*

MISCO

SALES ENGINEER



MISCO FABRICATORS, INC.

Designers, Builders, Fabricators of Heat Resisting Alloy and Stainless Steel Equipment

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TELEPHONE LORAIN 7-1545

News to Heat Treaters (cont.)

Atmospheres

Theory of Gases by Allen G. Hotchkiss, General Electric Co.

Exothermic Atmosphere by W. H. Boyd, Gas Atmospheres, Inc.

Endothermic Atmosphere by Ralph J. Perrine, Electric Furnace Co.

Dry Nitrogen—Base Prepared Atmosphere by Donald Beggs, Surface Combustion Co.

Dissociated Ammonia by M. R. Ogle, Drever Company

Atmospheres, Their Control & Safety by W. L. Besselman, Leeds & Northrop Co.

Tuesday Afternoon, November 2, 1954
Session Held in the International Amphitheatre

Atmosphere Applications

Carburizing by Walter Holcroft, Holcroft & Co.

The Equilibrium Relationship for Dew Point Measurement and Control by N. K. Koebel, Lindberg Engineering Co.

Practical Applications of Dew Point Measuring and Control by O. E. Cullen, Surface Combustion Co.

Brazing Movie by Westinghouse Electric Co.

Carbonitriding by Harold Ipsen, Ipsen Industries

Neutral Heat Treating by A. W. Frank, Hevi Duty Electric Co.

Sintering by Carl G. Paulson, C. I. Hayes, Inc.

Wednesday Afternoon, November 3, 1954
Session Held at the International Amphitheatre

Induction Sessions

Induction Melting by G. W. Holtz, Lindberg Engineering Co.

Induction Brazing by E. S. Goodridge, Induction Heating Corp.

Induction Heat Treating by H. B. Osborn, Jr., Tocco Div., Ohio Crankshaft Company

Sixty Cycle Induction Heating for Forming & Extrusion by John

A. Logan, Magnethermic Corporation

High Frequency Induction Heating for Hot Forging by Frank T. Chestnut, Ajax Electrothermic Corporation

Dual Frequency Heating for Hot Forging by Carl P. Bernhardt, Westinghouse Electric Corporation

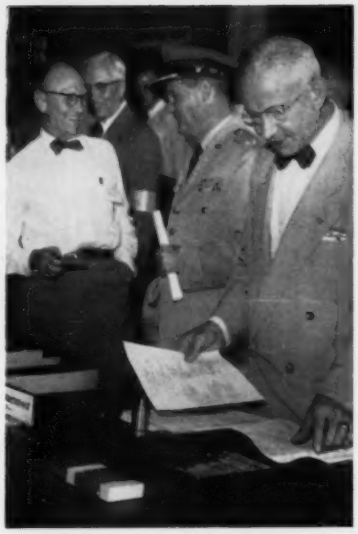
The IHEA program has been arranged by the Public Relations Committee of the Association. *C. H. Stevenson* of Lindberg Engineering Company is Chairman. Committee members include *C. H. Vaughan* of Electric Furnace Company; *C. F. Olmstead* of Lee Wilson Engineering Co.; *H. M. Heyn* of Surface Combustion Corp.; *William Adam, Jr.,* of Ajax Electric Co.; *William Benninghoff* of the Tocco Div., Ohio Crankshaft Co.; and *A. E. Tarr* of the Leeds & Northrup Co. President of the Association this year is *L. H. Gillette* of the Westinghouse Electric Corp. and the Executive Vice President is *Carl L. Ipsen.*

American Ordnance Association Visits Metlab Plant

The American Ordnance Association, Philadelphia Post, numbering more than 3,000 members, has initiated a program of visits to smaller plants in the Philadelphia (Delaware Valley) industrial area, which contribute materially to the defense program through the manufacture of Ordnance materials for the Army, Navy, Air Force and other Government agencies.

The first of these visits was held at the plant of the Metlab Co., Philadelphia, Pa., on Thursday, September 9th, 2 P. M. to 6 P. M. The attendance was limited to 250 guests who were given a conducted tour through the plant where they saw various heat treating processes in operation and viewed many of the actual parts so processed.

After the plant visit, guests enjoyed the recreation facilities of the Metlab field. The meeting closed with a brief business conference of the AOA Chapter and presentation of honored guests



Col. Douglass A. Rundquist, Chief, Philadelphia Air Procurement District, and Meyer L. Casman, former member of the Board of Review, Philadelphia Ordnance District, being greeted at the registration desk by F. S. Smyth, Secretary of Metlab.

and a short discussion on heat treating problems.

The specially invited guests included: Colonel T. J. Kane, Commanding Officer, Frankford Arsenal; Colonel G. L. Rundquist, Chief, Philadelphia Air Procurement District; Colonel W. M. Tisdale, Commanding Officer, Philadelphia Ordnance

Albert W. Gilmer, (second from left), Past President of the Philadelphia Post, is presented with inscribed silver platter by Henry W. Gadsden (l), Vice President of the Post, and a framed citation by Capt. J. P. M. Wright, (r), Staff Consultant, American Ordnance Association, Washington, D. C., as host Horace Knorr looks on.

District; and other government agency representatives.

C. I. Hayes, Inc.

New home of Hayes electric heat treating furnaces is nearing completion in Cranston, Rhode Island, where Mr. Carl I. Hayes started manufacturing nearly 50 years ago.

Brazing Technique

A new rotor-brazing technique, developed by Selas Corporation of America, Philadelphia, Pa., permits the brazing, in less than 5 minutes, of 64 copper bars to the end ring of a rotor for an industrial electric motor, through the use of Selas Superheat burners. Floor to floor time, which includes loading, heating, cooling, unloading, is 15 minutes, as compared with 1½ hours for other methods.

The cost of the natural gas consumed in the brazing operation is 3½ cents, as compared with up to $2.00 for torch brazing methods which use oxygen-fuel.

In the specially-designed equipment, the work rotates within an adjustable ring of 14 Superheat burners. Each of these burners is in effect a small jet

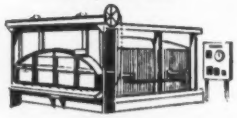
(Continued on page 36)

WHICH WAY?

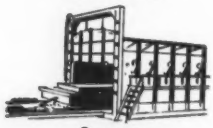
Have you a heat treating problem? A critical forging operation? If you do, you want to know which is the best heat process . . . the best furnace to meet your needs.

There is a GASMACO furnace and process that will meet your requirements exactly.

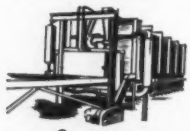
Gasmaco
Rotary Furnaces



Gasmaco
Box Furnaces



Gasmaco
Car Type Furnaces



Gasmaco
Roller Hearth Furnaces

For over fifty years The Gas Machinery Company has devoted its engineering and design skill to the building of industrial furnaces and gas generation equipment. Gasmaco fuel fired furnaces will help you solve your problems. They are built for many forging and heat treating processes: direct, radiant tube, and convection heating . . . rotary or straight through designs . . . high temperature roller hearth . . . cooling tables and conveyors, charging equipment and manipulators.

SINCE 1902

THE GAS MACHINERY COMPANY
16110 WATERLOO ROAD
CLEVELAND 10, OHIO

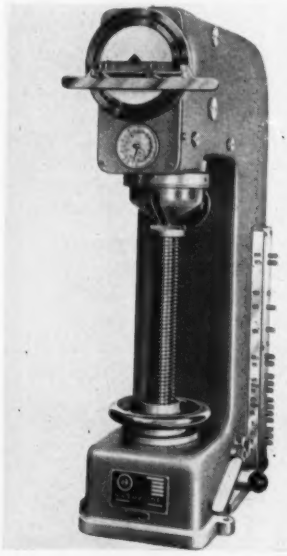
Designers • Fabricators • Erectors
Gas Plant Equipment and
Industrial Furnaces
THE GAS MACHINERY CO. (Canada), Ltd.
HAMILTON, ONTARIO

News to Heat Treaters (cont.)

furnace in which premixed air-gas is burned and hot products of combustion issue forth at high velocities through a slot in the burner. Localized heating is thus accomplished at high speeds, and all copper bars are brazed simultaneously.

Automatic Projection of Hardness Indentations

Reflex machines for Vickers, Knoop, Grodzinski, Brinell and Rockwell Tests, introduced by Gries Industries, Inc., New Rochelle, N. Y., feature numerous test load capacities (from 1 to 250 kg), push-button load selection, and automatic projection. All weight blocks remain permanently in the machine and the operator simply presses the push button for the particular



test load desired. The optical elements of the machines are said to be specially developed and made by Carl Zeiss. After the applied test load has been removed, the greatly magnified image of the indentation produced is automatically projected on the ground glass screen. Magnification up to 140 times permits precise measurements. The ground glass can be replaced by a photographic plateholder.

(Continued on page 38)

WHAT'S YOUR PROBLEM?

ED. NOTE: Frequently "*Metal Treating*" is asked for answers to heat treating problems of various types. These are referred to technicians, metallurgists, etc. The correspondence below is typical.

Send us your problem—we'll try to get the answer and publish it for your benefit and others.

Gentlemen:

We are particularly interested in what the difference in heat treating of M10 and M1 high speed steel for our cutting tools is required over the M2 and T1 steels which we have been accustomed to use in the past. Several companies have changed their heat treating methods over to accommodate M10 steels only and we find that there is a difference of opinion just what the correct procedure in hardening and the results obtainable from M10 and M1 over M2 and T1 are. If you have any literature regarding this problem would appreciate your sending it to the writer.

I. C. O'HARRA
Warner Gear Division
Muncie, Indiana

Dear Mr. O'Harra:

The use of M10 high speed steels in most instances has been discontinued inasmuch as it was primarily an emergency analysis due to a prospective shortage of tungsten. Also, at one time M10 was cheaper than M1 and M2 steels, however, this advantage has been discontinued.

The M10 type of high speed steel is usually considered undesirable from at least two standpoints:

(1.) It is very prone to decarburize and in order to prevent this, special equipment must be used.

(2.) The hardening range of this steel is very narrow and the possibility of overheating, even to the point of fusion in the grain boundaries, necessitates great caution and extreme accuracy of furnace temperatures. This is particularly true on cutting tools when seeking maximum hardness.

The M1 and M2 types of high speed steel are relatively easy to harden. These steels which have tendencies to decarburize also require protective procedures during heating, however not as much as the M10 types. The T1 series is most probably the easiest type to harden inasmuch as temperature control is not as critical as the others and maximum hardness is more readily obtained.

"What's Your Problem" Committee
Metal Treating Institute

Dear Sir:

Please let me have a folder about heat treatment. As foundry superintendent of a manufacturer of machine tools, up to now, aged outside, I am looking forward to heat treating and stress relieving a bench lathe. 7 feet long, 1,500 lbs. in weight and complementary parts.

Thanking you in advance, I am

PIERRE UTARD
Velez Sarsfield 368
Martinez, Argentina

Dear Mr. Utard:

The aging of machine parts in the outside atmosphere, although still in great use, is gradually being succeeded by elevated temperatures of much shorter durations, because of the time element which can range up to one year in some applications.

Normally elevated temperature aging is carried out in the range of 1000° F. to 1200° F., being sure that the part is thoroughly heated through, followed by air cooling. In some instances where extreme accuracy of dimensions are required the parts are furnace cooled from the high temperature at a rate not to exceed 20° F. per hour.

Where the parts are castings of intricate design great care must be undertaken in heating to the desired temperature, so as not to create excessive thermal shock. In many instances the heating rate should not exceed 20° to 50° F. per hour. However this is largely dependent on design.

"What's Your Problem" Committee
Metal Treating Institute

Tempilstiks®

quick, simple, accurate way to tell temperatures

use like a crayon

to control working temperatures in:

- welding
- flame-cutting
- tempering
- forging
- casting
- molding
- drawing
- straightening
- heat-treating in general

$2 each gives up to 2000 readings

It's this simple: mark the workpiece with the proper Tempilstik®. When the mark melts, the specified temperature has been reached.

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

Also available in pellet or liquid form

FREE —Tempil® "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

Metal & Thermit Corp. 100 E. 42nd Street, New York 17, N. Y.

furnace brazing of stainless steel

- Fully Automatic—no operating personnel required.
- High Purity—completely oxygen-free.
- Safe—NO explosion hazard.
- Economical—30% cheaper than dissociated ammonia.

Units available in 100 C. F. H. to 10,000 C. F. H. capacities.

nitroneal gas generator

. . . produces pure nitrogen with a controllable hydrogen content that can be varied to meet changing requirements and maintained at any desired percentage between .25% and 25%. This flexibility permits the use of proper gas for any material or process at lowest cost.

Applications include bright annealing, heat treating and furnace brazing of stainless steel, low and high carbon steels and non-ferrous metals.

Write for free, informative booklet No. 21.

BAKER & COMPANY, INC. PRECIOUS METALS

113 ASTOR ST., NEWARK 5, N. J.

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News to Heat Treaters (cont.)

NBFU Survey Shows Hazards In Metalworking

In recent years the metalworking industries have been beset by fire. Since 1942 large-loss fires in both heavy and light metalworking plants have increased 17 times. This is due in part to higher concentration of values in buildings, equipment and products exposed to fire and to hazardous new auxiliary processes and mixed occupancies.

These facts are brought out in a helpful 57-page survey on fire hazards and safeguards for metalworking industries issued recently by the National Board of Fire Underwriters.

According to the National Board, there were about 175 large-loss fires, those that result in damage of $250,000 or more, in the metalworking industries between 1942 and 1953, with an aggregate loss of approximately $150,000,000 as contrasted with the period from 1931 to 1942, when only 18 large-loss fires were reported with aggregate losses of $8,500,000.

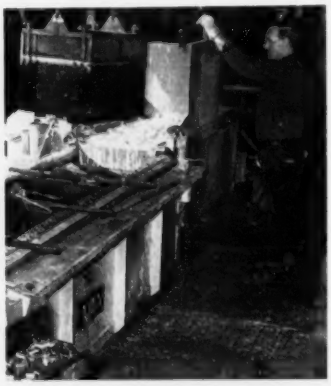
The survey points out that many new factors have entered the fire safety picture in recent years, but what is more important, is the presence of old fire causes in a more pronounced form. These are large-unprotected areas, the use of woodwork and plastic materials in fabrication processes, as well as the use of flammable liquids.

To receive a copy of this survey, "Fire Hazards in the Metalworking Industries," write to the National Board of Fire Underwriters, Research Department, 85 John Street, New York 38, N. Y. If you live in the Middle West, write to 222 West Adams Street, Chicago 6, Ill., and if west of the Rockies, to 465 California Street, San Francisco 4, California.

Austempering Shaver Heads

Electric shaver heads at Schick Incorporated, Stamford, Connecticut, are reportedly being austempered at the rate of approximately 30,000 pieces per day with rejects due to cracks held to less than five-hundredths of one per cent.

Shaver heads, the outer head 0.003" thick and the inner head 0.006" thick, are stamped from high carbon steel. The outer head has 128 slots in the ¼" by 1⅛" cutting plane. With such delicate shapes, distortion cannot be tolerated, particularly since the inner head oscillates 20,000 times per minute in contact with the outer head. A better method than oil quench and tempering was desired in order to hold distortion and hardness within closer limits, reduce rejects due to cracking, increase ductility of the heads, and streamline material handling. After investigating several possibilities a salt bath isothermal quenching furnace, produced by Ajax Electric



Company, Philadelphia, Pa. was installed. This 60kw furnace, with working dimensions 10 feet long by 2 feet wide by 22 inches deep was installed between the austenitizing bath and the rinse tank. The new cycle for austempering heads comprises a 5-minute pre-heat, 5-minute immersion in a 1550°F austenitizing bath, 1½ hours in the isothermal quenching furnace at 550°F, followed by a cold water wash.

Chief Metallurgist National Bearing Div.

John E. Fries, Jr. has been appointed chief metallurgist for

the National Bearing Division of American Brake Shoe Company. Mr. Fries joined the company in 1949 after graduation from Massachusetts Institute of Technology. He will continue to be located at the division's Meadville, Pa. plant, where he was formerly plant metallurgist.

Surface Combustion Announces Deferred Payment Plan for Industrial Furnace Equipment

Surface Combustion Corporation, Toledo, Ohio has announced that it has established a deferred payment plan for the purchase of the industrial equipment manufactured by its industrial divisions. The products covered by this plan include furnaces for the metalworking and producing industries and the glass industry. Also covered is the company's Kathabar humidity conditioning equipment, used for industrial processing and personnel comfort.

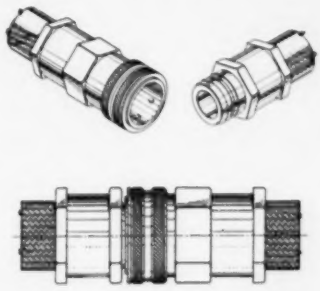
The plan provides for terms of payment up to three years and, in certain cases, up to five years. Down payments are normally 25% of the purchase price of the equipment. Financing charges 6% simple interest on the unpaid balance.

According to Surface, deferred payment offers many advantages to industrial furnace users. Financing of the equipment permits the purchaser to conserve his working capital for other requirements. In addition, it is claimed, the user gains the advantages of new cost-saving equipment at an early date; interest costs are tax deductible as operating expenses and current tax laws often permit the write-off of a major part of the equipment cost during the period in which payment is being made.

Quick-Seal Hose Coupling With Built-In Check Valves

Titeflex, Inc. 500 Frelinghuysen Ave., Newark 5, has announced that it is now in production on a complete line of its quick-seal, leak-proof hose couplings with built-in single or double check valves.

The Titeflex quick-seal hose coupling has, it is stated, already found wide application, particularly for high-pressure, heavy-flow fluid lines in the steel, oil, construction and other industries. This coupling is particularly suited for high-pressure, heavy-flow applications because of a simple construction which makes the hose line leak-proof



the moment the coupling is closed, and seals it tighter as pressure builds up inside. In addition, the construction provides a full-swiveling feature that prevents hose kinking, thus assuring long hose life and permitting rapid hose attachment.

This basic coupling structure has been combined with either a

(Continued on page 44)

FOR SALE

HARDENING FURNACE (1)
TEMPERING FURNACE (1)
Holcroft, gas-fired furnaces, capacity 2500 lb/hr. hearth width 57 in., door height 15 in., 2-zone control, pusher-type, 2-rail design. Complete with pusher mechanism, blowers, L&N instruments, and grids.
Hardening furnace—Max. temp. 1650° F., hearth length 18 ft., over and under fired, low pressure burners.
Tempering furnace—Max. temp. 1250° F., hearth length 26 ft., recirculating heaters, two burners.
See in operation—contact:
R. R. Schmidt
Purchasing Engineer
Caterpillar Tractor Co.
Peoria, Illinois

Burning Issues

Eclipse — Published by Eclipse Fuel Engineering Co. Rockford, Illinois

How to hedge against high maintenance with Eclipse Pressed Steel Pots

Why gamble on pot life when Eclipse Pressed Steel Pots can give you consistent performance . . . every time? You can insure yourself against costly repairs to bricking, burners, and control equipment by establishing safe, predictable limits for every type of pot and heat treating operation. You can replace them at regular shutdown periods knowing your delivery promises and profits are protected against the possibility of premature pot failures.

Uniform quality saves costly furnace repairs!

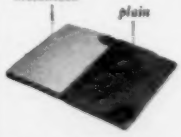
Formed from highest quality firebox, open hearth mild steel—selected right from the *heart of the ingot*—Eclipse Pressed Steel Pots have no hidden defects! Since laminated steel cannot withstand forming operations, you get *uniform quality* throughout the pot, from every pot you buy. They're not subject to grain growth at red heat. There are no cracks, stresses, or other critical areas to give you trouble.

No weld spots to worry about!

True, a welded steel pot is a cheap pot! But, weld spots leave your furnaces unprotected. Pressed Steel Pots, costing little more, are formed *in one seamless piece*, and all thin sections are of *uniform* thickness.

For high temps., Eclipse "Metallized" Pots resist heat oxidation and scaling

Looking at the sample below, you can see what "metallizing" does to extend pot life at high temperatures. Baked at 2250° F. in the open atmosphere, the coated pot section, left, shows no heat oxidation, or scaling. Under proper conditions, "metallizing" can double *or triple* pot life. You get all the advantages of a seamless steel container, plus a hearty, heat resistant outer surface!



Fast delivery from stock!

For fast service, and to keep your pot inventory costs low, Eclipse offers the largest selection of pots available, *anywhere*. Practically any standard size and shape can be shipped the same day your telegram or phone call is received.

Eclipse Fuel Engineering Co.
1018 Buchanan Street, Rockford, Illinois
Eclipse Fuel Engineering Co. of Canada, Ltd., Toronto, Ontario

Fig. 3—Temporarily-annealed 75S parts are placed in a refrigerator to retard hardening until they can be formed.

All types of 75S parts are annealed, when necessary, as follows:

(1) Heating or soaking at 800°F. ± 10°F. for 2 ± ¼ hours.

(2) Air cooling to 450°F. or less, as convenient.

(3) Heating or soaking at 450° ± 10°F. for 2 hours.

(4) Cooling in still air at room temperature.

However, 75S sheet stock is sometimes temporarily annealed by means of a solution re-heat treatment at a temperature of 920°F. ± 10°F. for the interval shown in Table I for the material in question. This is followed by a quench as previously indicated.

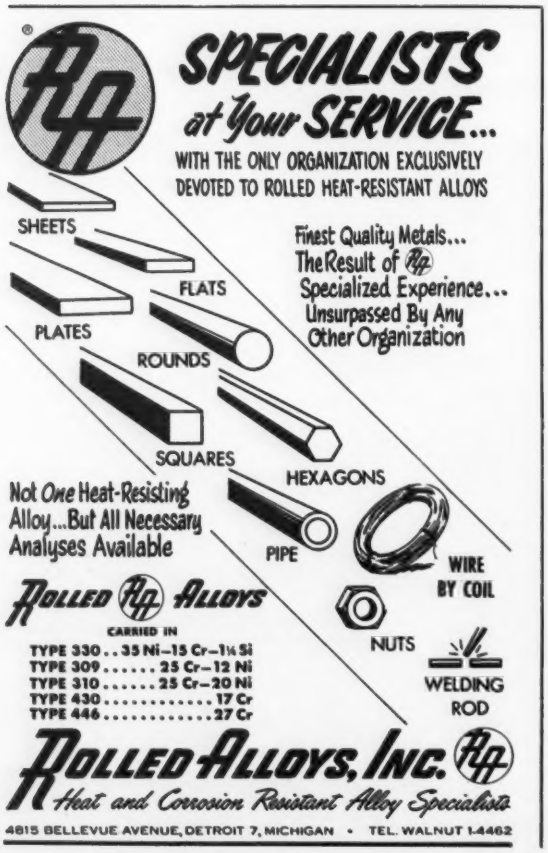
Temporarily-annealed materials may be fully hardened, when necessary, by means of the precipitation heat treatment.

In general, parts are temporarily annealed so that they can be subjected to forming operations without cracking or manifesting excessive springback. Such forming must usually be done within an hour after the parts are annealed, due to the tendency of temporarily-annealed materials to age harden in open air. However, the age hardening process can be retarded several days by refrigerating parts to—20°F. or less. See Fig. 3.

Production parts, representing the minimum and maximum 75S gauges being heat treated in each furnace, are tested each week by Convair's engineering test laboratory to determine whether they meet mechanical strength requirements. If parts from a given furnace fail to meet these requirements, the furnace is taken out of production until the cause of defects can be ascertained and corrected.

All heat-treated or annealed parts are carefully stamped by Convair inspection personnel at the end of each processing cycle, so that they will not be confused with untreated parts.

The salt baths used by Convair in heat treating 75S alloys comprise ½ oz. of sodium dichromate for each 100 lbs. of sodium nitrate in the new-tank condition. Sodium dichromate is added to used baths as necessary to neutralize the decomposition products of the heat treat salt. ■ ■ ■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TYPE 310 . . . . . 25 Cr–20 Ni
TYPE 430 . . . . . 17 Cr
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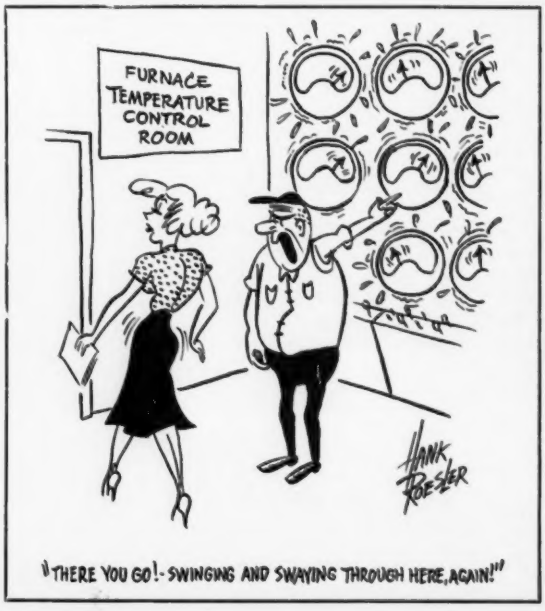
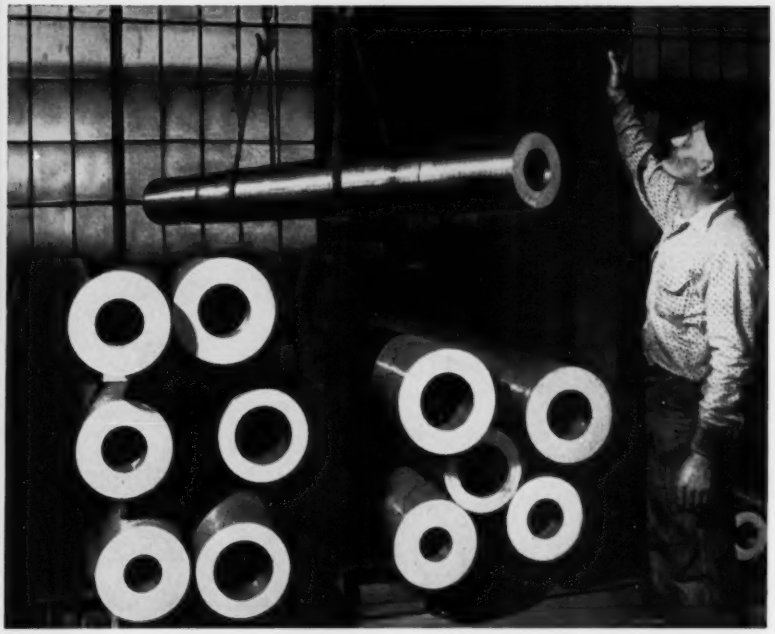


Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation



New Tool Steel Saves Production Time

BTR HOLLOW-BAR IDEAL FOR ALL RING-TYPE APPLICATIONS

Making ring dies? Draw rings? Ring gages? Back-up rings? Then you'll want to use BTR Hollow-Bar, a new Bethlehem tool steel which is especially designed for this type of service.

BTR stands for "Bethlehem Tool Room," our popular oil-hardening tool steel. BTR Hollow-Bar is made by an improved Bethlehem process called High-Speed Trepanning. By this method, the center metal of the hammer-forged round bars is cored out and the bars are then rough-turned on the outside.

BTR Hollow-Bar saves production time and delivery time because your distributor can cut off rings from the bar to any desired length. It also enables you to save shop time, because there's no need to wait for forged rings or discs. What's more, in most instances there's no drilling, rough turning, rough boring, or rough-facing required.

BTR Hollow-Bar is furnished in the annealed condition to a Brinell of 202 max, and is smooth-machined on both the inside and outside surfaces. Stock lengths for small sizes are 6 ft to 8 ft, and for large sizes 8 ft to 12 ft.

Typical Analysis

Carbon	0.90	Chromium	0.50
Manganese	1.20	Tungsten	0.50
		Vanadium	0.20

If you'd like to know more about Hollow-Bar, talk it over with your distributor. Or write to us at Bethlehem, Pa.

66 HS MACHINES CAR WHEELS

Here the rim contour and front face of a "one-wear" wrought-steel freight-car wheel are being machined. The average depth of cut is 1/32 in. Both the roughing and finishing tools used in this machining operation are made of Bethlehem 66 HS. This is our moly-tungsten grade of high-speed tool steel. In addition to featuring wear- and shock-resistance, 66 HS also has good red-hardness.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

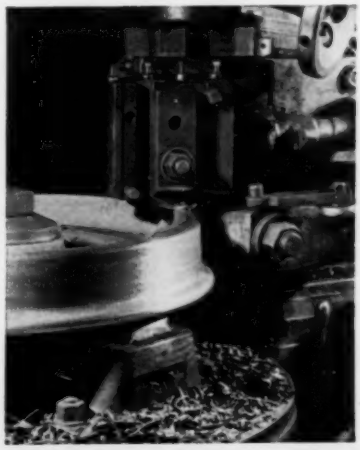
It Doesn't Pay to Punch All the Way Through

One of the best ways to improve the tool life of punches is to control the stroke of the punch. It is not necessary for a punch to go completely through the hole. When a punch does go through the hole, rapid wear occurs. This increases clearance, which in time increases the load necessary for punching, and results in burred edges.

When a punch has penetrated part way through the stock, "snapping" occurs and the "button pops out." The amount of penetration of punch before "snapping" takes place depends upon the material being punched, and the stock thickness. In general, the softer the material the greater the penetration required; conversely, a hard or brittle material requires less penetration.

The penetration on soft, thin stock may be as high as 90 pct of the stock thickness. On hard, thick stock it may be as low as 40 pct. The least amount of penetration which will bring out the "button" is best. What the penetration should be must be determined on each job.

Proper control of penetration of the punch by adjustment of the stroke of the press will pay off in decreased wear on the punch, resulting in better quality parts and increased tool life.



livered in cylinder lots by the supplier and the empty cylinders are disconnected and brought back to the supply depot for refilling. Advantages are:

Low installation cost
Can be stored in building
Less stringent regulations
Not a permanent installation

Disadvantages:

High cost of product (compared to bulk installation)
Required labor to connect and disconnect

Bulk Storage: The next step in distribution is to small bulk systems consisting of one or more 1000 gallon gross capacity tanks. Product is delivered by means of truck tank unit for filling tank at site. Advantages are:

One storage system rather than multiple cylinder storage
No plant labor required to serve system
Low product cost
Installed in accordance with regulations

Disadvantages:

Installation cost
Semi-permanent installation
Usually installed outside of main building

Tank Car Storage: For the large users of NH_3 a tank car installation, Fig. 5, may be the most economical. This is handled by tank car or large transport units delivering to the plant site. The advantages of this system are:

Lowest unit cost
Large storage available

Disadvantages:

Capital expenditures for equipment
Availability of railroad siding
Unloading personnel required

A visual guide to the economic breaking point between cylinder operation and bulk operation is given in Fig. 6 indicating cost per pound for cylinder deliveries, tank truck bulk deliveries, and tank car deliveries compared to annual consumptions. This chart takes into consideration the delivered cost of bulk deliveries plus the additional amount required to write off capital expenditure and 6% interest for the bulk systems. For comparative purposes a small bulk plant designed for tank truck installation is based on an amortization of two years consisting of from one to three 1000 gallon anhydrous ammonia storage tanks completely installed. For tank car installations, amortization is considered on a five year basis for an 18,000 gallon gross capacity storage tank, tank accessories, unloading compressor, miscellaneous pipe and fittings for an installed price of approximately $20,000.00

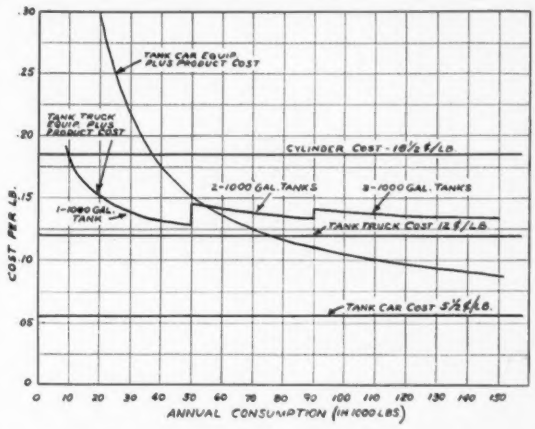


Fig. 6—Cost comparisons between Cylinder, Tank Truck and Tank Car Installations.

It is noted on the chart that if annual consumptions of 11,000 lbs or more of anhydrous ammonia are used, definite savings with bulk storage are obtained. For much larger anhydrous ammonia consumptions annually, it might be well to consider the installation of a tank car type operation. At an annual consumption of 80,000 lbs. a tank car installation would reduce operating costs by $5600 per year and after five years this operations cost would denote a savings of $10,400.00 based upon the same annual consumption.

The above analysis of the economics of anhydrous ammonia systems compared to hydrogen or nitrogen plant installations strongly indicates the possibility for substantial reductions in plant operation costs. Such savings are indeed important for economic plant operation in a competitive market.

The author is deeply indebted to the following for their valuable assistance in preparing this study:
Mr. R. N. Dawson—Armour and Company
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Mr. H. Brennan—C. I. Hayes Inc.
Mr. George S. Ewing—Sargent & Wilbur
Mr. J. A. Roberge—Baker & Company
Mr. W. J. Meyer—Thomas Gas Contractors, Inc.
Mr. Arnold Hevert—Registered Professional Engineer State of New Jersey

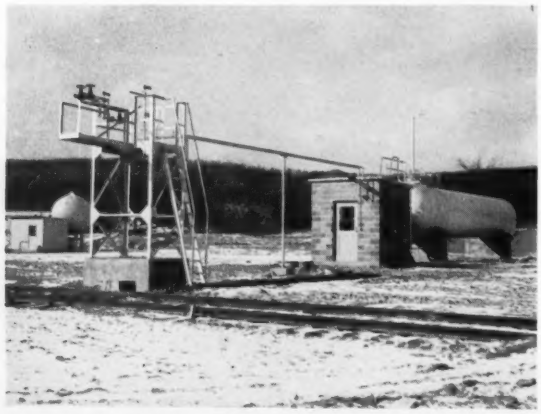


Fig. 5—A typical tank car installation adjacent to railroad siding.

Determination of Unit Costs (cont'd)

the commercial plant and the heat treating department of a manufacturing plant. I believe this would be appropriate, since our industry serves thousands of metal manufacturing plants, many of which do some of their own heat treating. Heat treating departments in these plants have sometimes been called, "Captive Heat Treating Plants." I prefer not to use that name because, to me, it seems to imply something sinister or improper. So I shall refer to them here as industrial heat treating departments.

Industrial heat treating departments, like commercial plants, run the gamut as to volume and types of heat treating done. There would appear to be no reason why cost methods outlined in these papers could not be adapted to the industrial heat treating departments. The same basic elements of cost are present—labor, treating materials, maintenance, power and fuel, building occupancy, depreciation, taxes, insurance, etc. However, necessary provisions must be made in the accounting procedures of the business to insure that all costs applicable to the heat treating department are so recorded on the books. Of course, if this is not done, the result will be an understatement of heat treating costs and an overstatement of costs elsewhere in the manufacturing operations. An analogy of this statement is the one made in one of the previous articles to the effect that improper methods of allocating expenses will cause an overstatement of costs on some furnaces and an understatement of costs on others.

Properly developed unit costs should be of equal value in either the industrial heat treating departments, or the commercial plant. In the industrial plant they would provide a reliable method of figuring the heat treating costs of various parts that are incorporated in the products manufactured. The heat treating is, in itself, the end product so far as the commercial plant is concerned and unit costs are the basis for correctly pricing its services.

By way of summarizing the papers which have been presented by this Committee, we have tried to:

(1) Focus attention upon all elements of cost involved in the operation of a heat treating plant.

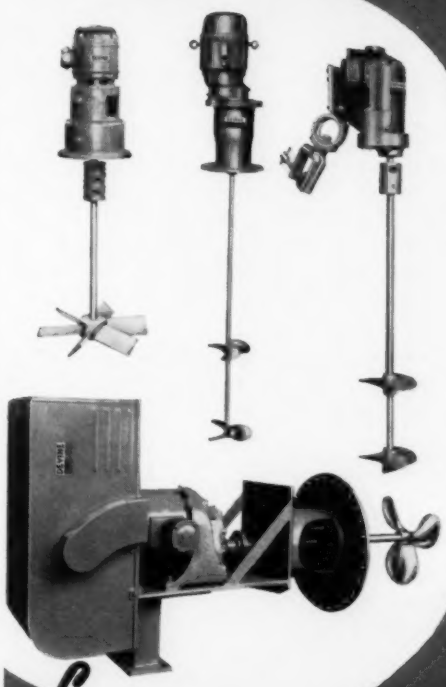
(2) Suggest methods and procedures by which the different types of cost may be properly charged to the various productive units.

(3) Develop a practical and sound approach to the determination of unit costs.

Everyone, we feel, recognizes that it would not be possible to draft a cost system, in complete detail, that would fit all heat treating plants. There are too many variables. The Committee hopes, however, that it has contributed, in some measure, to a better understanding of the problem. ■ ■ ■

Devine

Agitators



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Here's Why in a Nutshell: You get 6750 cubic feet of mixed hydrogen and nitrogen when a single 150-pound cylinder of Barrett Brand Anhydrous Ammonia is disassociated at normal temperature and pressure. One of the most economical sources of disassociated hydrogen and nitrogen for metallurgical uses!

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Fast Delivery. Barrett Brand Anhydrous Ammonia is stocked coast-to-coast in 150-, 100- and 50-lb. cylinders. An adequate supply of cylinders in all sizes helps assure fast delivery in the size you want. If you use *large* quantities, ask about our tank truck delivery service–you'll save money.

FREE Technical Help. Technicians specially trained in the use of Anhydrous Ammonia for metal treating will help you. No obligation. Also, valuable handbook, "Guide to Use of Barrett Ammonia in Cylinders" shows most economical usage; contains chemical properties, handling, charts, etc.

FREE! Ammonia Leak Detector Safety Kit! Pocket-size, this new handy kit quickly detects ammonia leaks. May be used over and over. Write today!

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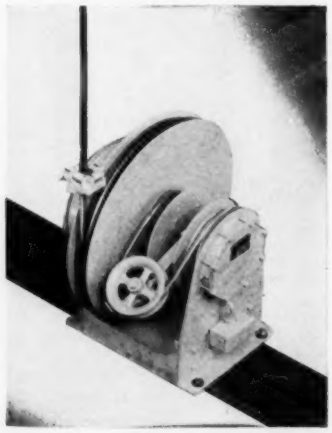
News to Heat Treaters (cont.)

single or double check valve, producing a type of coupling which has the above features and, in addition, closes off either one end (single-check valve) or both ends (double-check valve) of the fluid line the instant the coupling is opened. The check valves are automatically opened, permitting full fluid flow, the instant the coupling is closed.

The built-in check-valve arrangement eliminates the need to shut down pumps or close valves in order to break the connection; it avoids loss of valuable or hazardous fluids when the line is opened; and it eliminates the need to drain lines prior to uncoupling.

Gleason Reels in Pyrometer Service

Twenty type WB Gleason Reels were recently installed for pyrometer service in a large steel mill. The type WB is a spring-driven reel of unique design which takes up and pays out electric cords and cables without contacts, collector rings or other electrical parts. Reels are manufactured by the Gleason Reel Corp., 740 N. Plankinton Avenue, Milwaukee 3, Wisconsin.



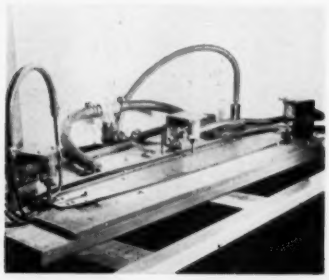
"Window shade" action is provided by locking dogs. Reels are hung from overhead beams near the hearths and the pyrometer lead can be quickly pulled down, held without tension while read-

ings are taken, and then released and automatically rewound.

Induction Hardening Guide Bar Tracks

Portable chain saw guide bar tracks are now hardened by a new "Thermatool" high frequency method. Guide bars vary in length from 21" to 72". The saw chain rides on two tracks, each about $\frac{1}{16}$" wide.

Conventional heat treatment has produced guide bars having a comparatively limited life. Contamination by sand, dirt and



rosin induce very rapid deterioration. Hardening of the track edges to Rc60 has reportedly resulted in greatly increased wear resistance, without loss of flexibility or toughness.

The guide bar hardening fixture illustrated, required, in its design, the application of little known and rarely used electromagnetic principles, according to the designer-builder, New Rochelle Tool Corp., 322 Main St., New Rochelle, N. Y.

Surface Combustion to Exhibit New Automatic Carbon Controller at Metal Show

A new Surface Combustion "Autocarb" automatic continuous carbon controller will be featured at the Metal Show to be held in Chicago, November 1-5, 1954. This instrument, used in conjunction with the 'Surface' Dew Point Recorder, provides for continuous control of the carbon potential of the furnace atmospheres. It is used for control of furnace atmosphere in gas carburizing, clean hardening, and other heat treating processes.

Lab Dissociated Ammonia Generator

Extensive tests have been completed by Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill., on the first commercial laboratory size dissociated ammonia generator. This unit, the "Lab-Hyam," is now being offered to metallurgical laboratories for test and pilot runs.

A 35-15 alloy catalyst chamber with a vertical inlet and a vertical outlet tube was designed to fit into Lindberg's laboratory pot crucible furnace. The tubes are welded to the cover plate of the furnace to form a complete gas tight unit. Pure nickel shot surround the tubes within the catalyst chamber. Tests have shown that 99.90% dissociation is accomplished at 35 C.F.H.

The furnace is brought to an operating temperature of 1900° F. and held there by an automatic controller to eliminate possibility of burning out elements in case of shorts.

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Plus GOOD BASKETS
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In Fact, *THE BEST,*

because they are made of the proper heat resistant alloys to start with and are designed, based on long experience, to withstand thermal stresses over a maximum period. Basket shown, handling parts to be carbo-nitrided, is properly reinforced, skillfully constructed and giving highly economical performance users report.

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367-405 West First Street
Boston 27, Massachusetts

INTERNATIONAL NICKEL CO., INC.
67 Wall Street
New York 5, New York

MISCO FABRICATORS, INC.
1999 Guoin Street
Detroit 7, Michigan

THE PRESSED STEEL COMPANY
Wilkes-Barre, Pennsylvania

ROLLED ALLOYS, INC.
4815 Bellevue Avenue
Detroit 7, Michigan

ROLOCK INC.
1232 Kings Highway
Fairfield, Connecticut

STANWOOD CORP.
4825 W. Cortland St.
Chicago 39, Ill.

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FURNACES

DEMPSEY INDUSTRIAL FURNACE CORP.
125 Main Street
Springfield 1, Mass.

DENVER FIRE CLAY COMPANY
2301 Blake Street
Denver, Colorado

DREVER COMPANY
736 E. Venango St.
Philadelphia 34, Pa.

ECLIPSE FUEL ENGINEERING CO.
Rockford, Illinois

THE GAS MACHINERY COMPANY
16110 Waterloo Road
Cleveland 10, Ohio

HEVI DUTY ELECTRIC COMPANY
Milwaukee 1, Wisconsin

INDUSTRIAL HEATING EQUIPMENT CO.
3570 Fremont Place
Detroit 7, Michigan

LINDBERG ENGINEERING CO.
2446 W. Hubbard Street
Chicago 11, Illinois

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FURNACES (Salt Bath)

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

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GASES

ALLIED CHEMICAL & DYE CORP. NITROGEN DIVISION
40 Rector Street
New York 6, New York

ARMOUR AND COMPANY AMMONIA DIVISION
1355 W. 31st Street
Chicago, Illinois

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GAS GENERATORS

BAKER & COMPANY, INC.
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Gulf Building
Pittsburgh 30, Pennsylvania

E. F. HOUGHTON & CO.
303 W. Lehigh Avenue
Philadelphia 33, Pennsylvania

PARK CHEMICAL COMPANY
8076 Military Avenue
Detroit 4, Michigan

SUN OIL COMPANY
Industrial Products Department
Philadelphia 3, Pa.

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REFRACTORIES

DENVER FIRE CLAY COMPANY
2301 Blake Street
Denver, Colorado

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SALTS

AMERICAN CYANAMID COMPANY
30 Rockefeller Plaza
New York 20, New York

ECCO CHEMICAL CORPORATION
19th Street & Park Avenue
Weehawken, New Jersey

E. F. HOUGHTON & CO.
303 W. Lehigh Avenue
Philadelphia 33, Pennsylvania

MITCHELL-BRADFORD CHEMICAL CO.
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PARK CHEMICAL COMPANY
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GENERAL MANUFACTURING COMPANY
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METAL & THERMIT CORP.
100 East 42nd Street
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TOOL STEELS

BETHLEHEM STEEL COMPANY
Bethlehem, Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA
Pittsburgh, Pa.

MANUFACTURERS' LITERATURE

The literature listed below contains information of interest to heat treating organizations. For your Copy write direct to the manufacturer and be sure you mention seeing it reviewed in "METAL TREATING".

SOLENOID VALVES

Eclipse Fuel Engineering Company, Rockford, Illinois has announced the availability of a new 4-page bulletin No. M-500 covering design and performance characteristics of its line of "DO" (diaphragm operated) solenoid valves. The bulletin contains photographs, line drawings, specifications and tables. The complete DO solenoid valve line available in six pipe sizes is illustrated. Cross section views show open and closed positions of the valve's only two moving parts—solenoid plunger and synthetic rubber diaphragm. Other drawings give over-all valve dimensions.

VIBRATION AND SHOCK MOUNTINGS

"How to stop vibration, eliminate shock, reduce noise and cut down on the wear and tear of industrial machinery," is the subject of a new booklet No. 850 issued by Robinson Aviation, Inc., Teterboro, N. J. The booklet describes vibration and shock control based on the employment of resilient, primary load-carrying cushions of knitted metal wire. Examples of typical industrial mounts and mounting systems are illustrated and engineering data given.

NEEDLE CONTROL VALVES

Design details and operating characteristics of its complete line of needle type valves are explained by The Foxboro Co., Foxboro, Mass., in a new 8-page bulletin, 5C-13. Engineered for applications requiring precise control of low rates of flow, the needle valve is described as an integral part of a complete control system, suitable for use over a wide range of operating conditions. Reference material includes a table of nominal needle sizes with corresponding valve coefficients, and a characteristic curve showing the per cent of maximum flow in relation to the per cent of total lift. A two-page feature, "What Size Valve?", gives formulas and instructions for calculating the size of a suitable control valve for use with liquids, gases and steam.

PLANT MOBILITY

A 4-page bulletin, R541, describing the benefits that industrial plants can derive through mobility of their machines is now available through the Barry Corporation, 1000 Pleasant Street, Watertown, Mass. The bulletin gives the results of a timed test involving the relocation of a production line in 23 minutes, which demonstrated savings in money, time and labor that result from plant mobility. Application of plant mobility principles, the bulletin points out, offers many other advantages aside from machine mobility, including savings of capital investment and better organization of work flow.

NEW MAGNETIC-PARTICLE TESTER

A bulletin that explains the operation of a new magnetic-particle test unit called "Portaflux" is available from the Research & Control Instruments Division, North American Philips Co., Inc., 750 South Fulton Ave., Mount Vernon, N. Y. Data covers method used in checking steel and iron objects for surface cracks or discontinuities. Objects under study are magnetized either by passing a current through the metal or through a surrounding cable in the form of a coil. Complete unit weighs 45 lbs. Magnetic iron oxide or precipitated iron powder distributed over the surface aligns itself in such a way that surface defects may be clearly located. Powders are usually black, gray or red to make the pattern readily visible to the naked eye.

ELECTROPLATING PROCESSES

Hanson-Van Winkle-Munning Co., Matawan, N. J., offers a new four-page bulletin, No. P-100, on its electroplating processes. The bulletin describes and lists key characteristics of 16 processes. These include seven nickel plating, three zinc, one cadmium, one copper with and without periodic reverse current, two silver, one lead and one bright ternary alloy plating process.

TABLE-TYPE BLAST CLEANER

A new bulletin, No. 944, describing a new table-type airless blasting machine has been published by American Wheelabrator & Equipment Corp., 1175 South Byrkit St., Mishawaka, Indiana. The machine, called a 72" Wheelabrator Swing Table, is distinct from other swing-table-type airless blasting machines in that it requires no pit at all for the abrasive hopper. One part of the bulletin shows how loading and unloading of this machine can be done very rapidly by means of auxiliary tables. These are handled either

by lift truck or by jib crane, and one of these can be loaded and unloaded while another one is on the main table and undergoing blast cleaning.

Complete electrical and mechanical specifications and views showing overall dimensions are included. The various mechanical components of the machine are described and shown in the many illustrations.

HEAT TREATING POTS, BOXES

Bulletin No. 5 has just been released by Standard Alloy Co., Inc., 1679 Collamer Rd., Cleveland, Ohio, on eight types of heat and corrosion resisting alloy cast heat treating pots, tubs, and carburizing boxes. Complete specifications are given for seventeen round pots for salt, cyanide and lead solutions; six rectangular tubs; thirty-one rectangular carburizing boxes; and nineteen round carburizing boxes. These many types and sizes have proven most popular with heat treat operators according to the company.

HEAT RESISTING PROCESS EQUIPMENT

Misco Fabricators, Inc., 1999 Guoin Street, Detroit 7, Michigan, has available, upon request, a four page folder on carburizing boxes, trays, heat-treat fixtures, baskets, retorts, hoods and muffles. Complete with illustrations, this folder is said to illustrate the wide versatility of basic design, engineering and fabrication techniques, incorporated in Misco heat resisting alloy products.

PLATING RECTIFIERS

A new 8-page, bulletin, No. 5500, contains hints on installations of plating rectifiers, describing different arrangements best suited for certain installations is available from the Ther Electric & Machine Works, Dept. MTN, 17 South Jefferson St., Chicago 6, Ill. Descriptive photographs are included to demonstrate the different arrangements. Information concerning the desirable features of rectifier construction is outlined in detail. It shows "dripproof" laboratory models together with a complete description of the other various types of rectifiers that are available for electroplating and anodizing.

TRANSMISSION BELTS

"Poly-V drive," a new method of belt power transmission is described in brochure 6638 just issued by the Manhattan Rubber Division, Passaic, N. J., developers of the new belt and V-grooved sheave. Design characteristics of the single, endless belt with molded lengthwise ribs, are explained in line-drawings that show fourteen specific advantages are claimed for the drive.

VACUUM METALLIZING

This process is fully described and many of its applications are illustrated in a new brochure, "Vacuum Metallizing," which has just been issued by F. J. Stokes Machine Company, 5500 Tabor Rd., Philadelphia, Pa., builder of vacuum metallizing equipment. The brochure itself is a specimen of the silver-bright finish obtained by this process: its cover is a sheet of acetate which has been vacuum metallized with a coating of aluminum 3 millionths of an inch thick before being bonded to the paper stock. In the brochure are specifications for the complete range of Stokes vacuum metallizing equipment,

TENSILE AND IMPACT PROPERTIES

Bulletin A-68 available from International Nickel, New York 5, N. Y., provides over 70 mechanical property charts to show the properties which may be regularly expected in the nickel alloy steels in various section sizes. General characteristics of each type briefly described as an aid in the selection of steels for particular applications.

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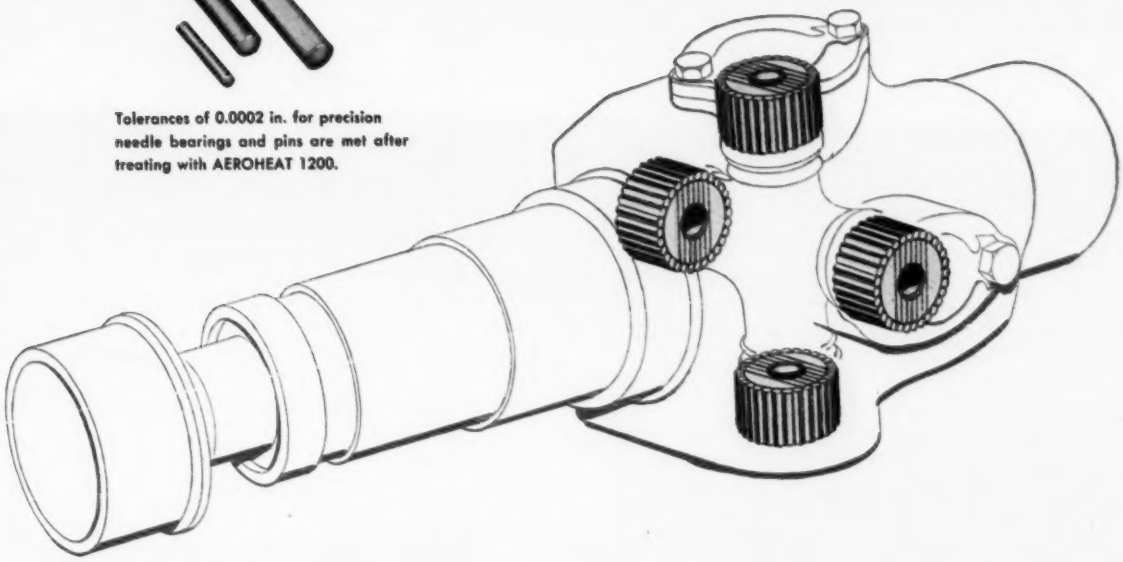

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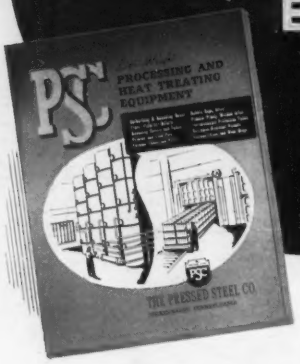

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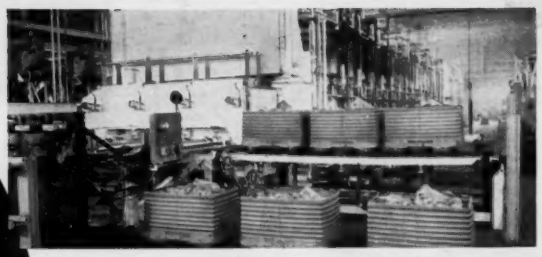

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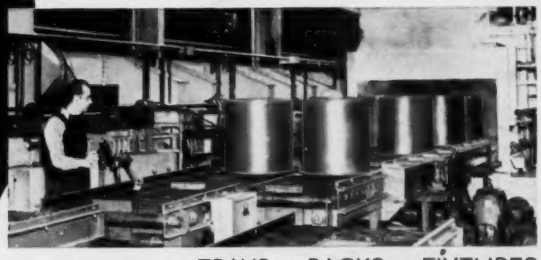

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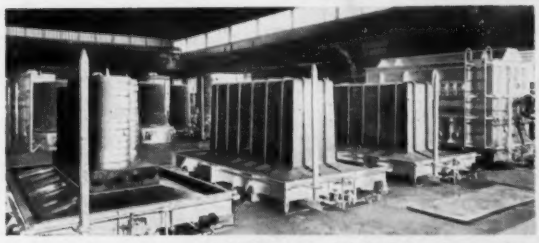
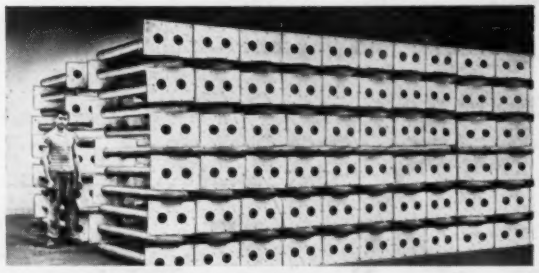


COVERS · TUBES: Annealing



FURNACE TUBING: Internal, External

As one of the originators and leading suppliers of light-weight welded alloy heat-treating equipment, The Pressed Steel Company offers you a wealth of experienced engineering assistance and production know-how. We believe you will find the new PSC Catalog 54 a helpful standard reference concerning equipment for every heat-treating purpose in metal-working plant, foundry and steel mill.

Weigh Up to 2/3 Less. Save Time and Fuel

The featured light weight of PSC units can effect impressive savings in fuel and heat-up time, as well as in furnace space. Installation records also show PSC sheet alloy equipment offers 2 to 7 times longer service life. PSC units are furnished in any size or design, and for any temperature up to 2200°F. Being independent of any metal producers, we regularly fabricate the complete list of alloys. Send blue prints or write as to your needs.

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